New Civic Development Phase 2 Project: Parking Garage and Green Roof

Environmental Effects Analysis

Environmental Impact Statement and Tree Conservation Report Update

Addendum #1

June 2022

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Environmental Effects Analysis

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Prepared by:

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Client:

The Ottawa Hospital

Prepared for:

Public Services and Procurement Canada

National Capital Commisson

The City of Ottawa

June 2022

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SECTION A: PROJECT IDENTIFICATION

Project Title	New Civic Development: Phase 2, Parking Garage
Project Location	930 Carling Avenue/520 Preston Street, Ottawa, ON
Lead Authority	Public Services and Procurement Canada (PSPC)
Contact Name:	Nicole Merkley
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SECTION B: PROJECT DESCRIPTION AND DESCRIPTION OF THE ENVIRONMENT

1.0 INTRODUCTION

In March 2022, the Environmental Effects Analysis and Environmental Impact Statement and Tree Conservation Report Update (EEA/EIS and TCR) in support of the Phase 2 Project was approved and signed by Public Services and Procurement Canada and the National Capital Commission on March 11, 2022. Subsequently, a Federal Land Use and Design Approval (FLUDA) was issued on March 24, 2022, that enabled Early Works to commence on the Site including site mobilization, site hoarding, tree protection and clearing, construction access roads and detouring of the Trillium Pathway.

The approved EEA/EIS and TCR includes future commitments that are to be completed through the developed design process as well as evaluating any changes to the design as a result of the on-going design efforts. As such, the objective of this Addendum is the following:

- Provide additional information made available through developed design;
- Evaluate any associated impacts; and
- Identify any additional mitigation measures that may be required to avoid or minimize impacts.

This Addendum accounts for the following new or updated information related to the Phase 2 project:

1. Impact Assessment and identification of mitigation measures for a temporary berm outside of the Phase 2 Project Area Results of a Life Cycle Assessment (Carbon Intensity Analysis);
2. Results of a review of Cumulative Effects;
3. Documentation of additional Consultation Activities undertaken since the approved EEA/EIS and TCR and;
4. Update drawings attached to the Tree Conservation Report to replace a duplicate Figure 2B and replacing with the missing Figure 2C. This has been provided as **Appendix A**: Tree Inventory Phase 2 Parking Garage.

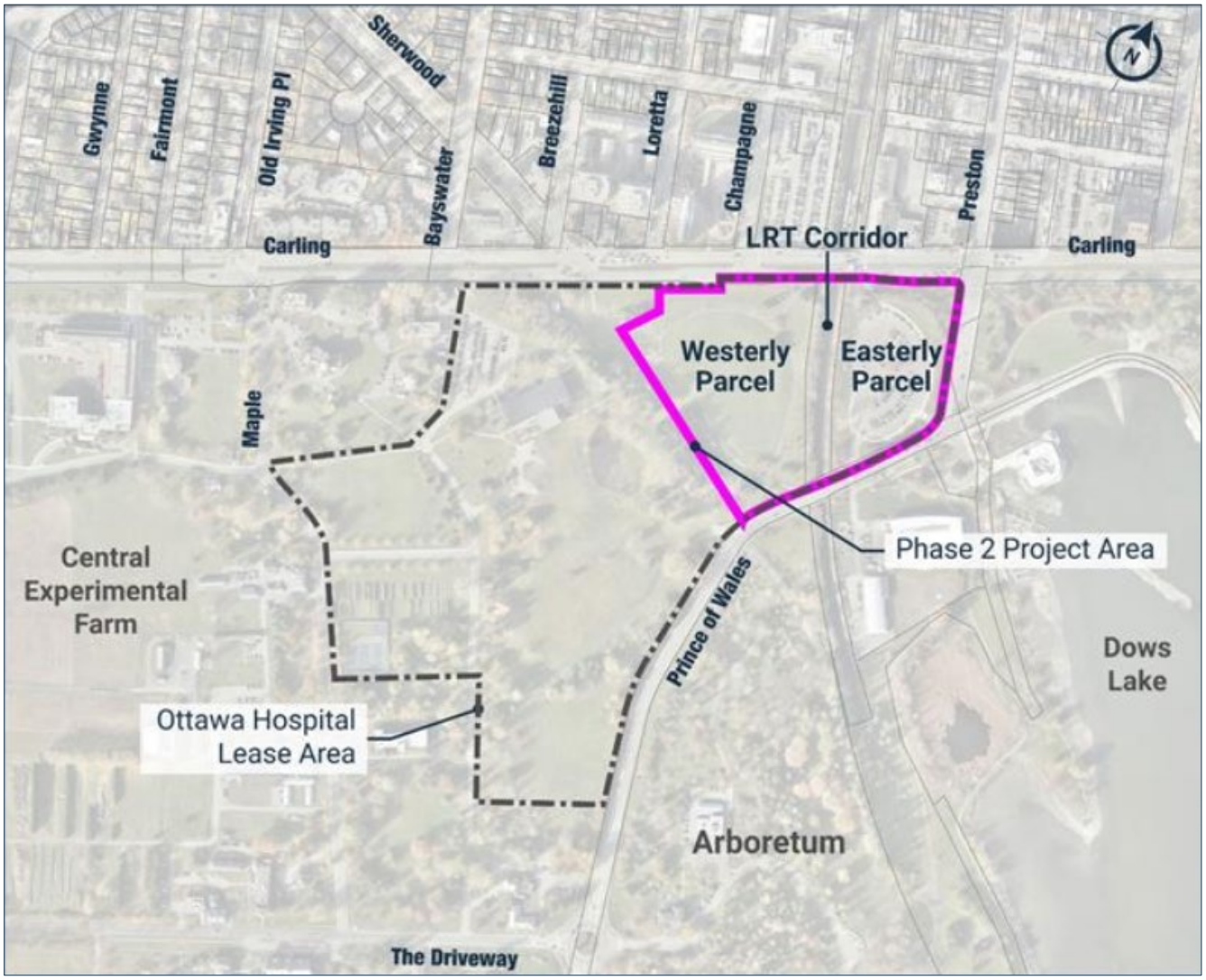
1.1 Background Information

In May 2021, TOH submitted a FLUDA application to the National Capital Commission (NCC) and Master Site Plan Control Application to the City of Ottawa for approval of a Master Site Plan for the NCD site and was approved by the NCC Board of Directors on October 5th, 2021 and Ottawa City Council on October 13th, 2021. A phased approach to construction of the NCD is planned and will require separate FLUDAs and Site Plan Control Approvals for each phase.

A FLUDA from the NCC is required to implement the Phase 2 project. This report has been prepared in accordance with the requirements and guidance outlined in Sections 81 to 91 of the *Impact Assessment Act* (IAA), where an Environmental Effects Analysis (EEA) is required of Federal Authorities with a role/interest in the project in order to determine the likelihood of significant environmental effects prior to issuing project approval or other decision in order for the project to proceed. Public Services and Procurement Canada (PSPC), as the landowner, and the NCC are considered lead and secondary federal authorities, respectively. A Project Description was posted on the Impact Assessment Agency of Canada's Registry (https://iaacaeic.gc.ca) for a 30-day public review and comment period. All comments received were considered in making a determination of significance.

The approved EEA report and this Addendum are intended to meet the requirements for a federal Environmental Effects Analysis (EEA) under Section 82 of the Impact Assessment Act of Canada (IAAC) and also as an update to the Environmental Impact Statement (EIS) and tree conservation recommendations (that was prepared for the Master Site Plan applications (Parsons, 2021) to meet the EIS requirements as it applies to the Phase 2 project area (**Figure 1**) and the temporary berm (**Figure 2**). While this addendum is subject to the requirements of the IAA (as the berm work is a minor, and temporary component of the overall Phase 2 Project), no additional posting on the IAA registry is anticipated, as significant consultation has already been completed for the Phase 2 Project.

Figure 1: New Civic Development Site for The Ottawa Hospital



Section F in the approval of the EEA/EIS and TRC for the Phase 2 Project entitled Future Commitments and Refinements to the Plan noted that any new information or changes to the Phase 2 Project resulting in new impacts, or new impacts outside the Phase 2 area would require an addendum.

1.2 Supporting Studies and Drawings

A number of studies and drawings provided under separate covers have been prepared and submitted to the City of Ottawa and Federal Authorities as part of the Master Site Plan and the Phase 2 Project Planning and Approval submissions. The following supporting studies and revision dates are listed in **Table 1**.

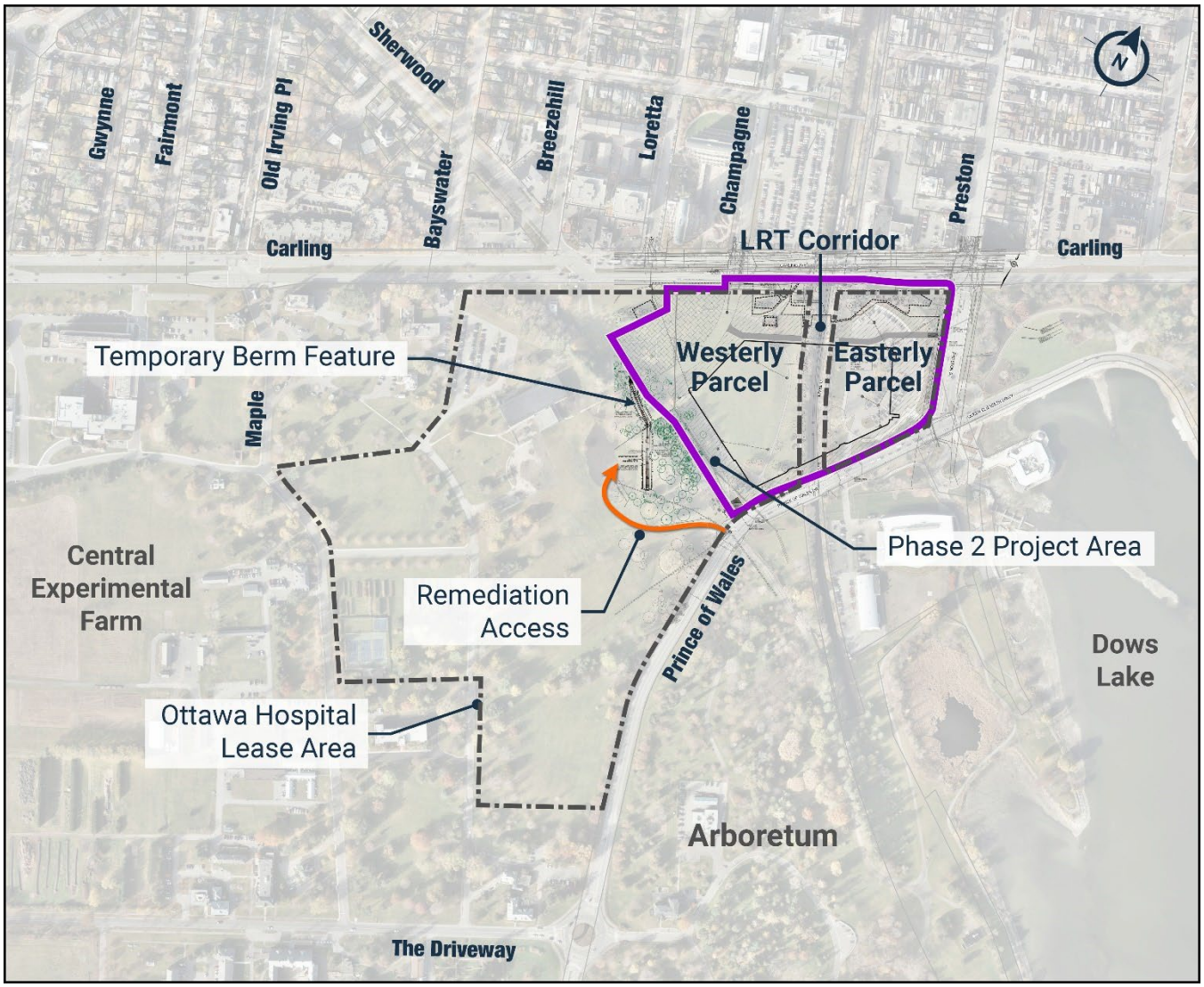
Table 1: Drawings and Studies

Phase 1: Master Site Plan	Phase 2 Project: Parking Garage and Green Roof
Parsons. August 2021. Design Brief and Planning Rationale – Master Site Plan. Applications for: Site Plan Control, Master Site Plans and Lifting of Holding Zone.	Parsons. January 2022. Design Brief and Planning Rationale. Application for Site Plan Control – Phase 2 Project, Parking Garage and associated drawings.
Parsons. July 2021. Transportation Impact Assessment and Mobility Study, New Civic Development for the Ottawa Hospital.	Parsons. February 2022. Transportation Impact Assessment, Addendum #1, New Civic Development for the Ottawa Hospital.
Parsons. July 2021. Master Servicing Plan, New Civic Development for the Ottawa Hospital.	Parsons. September 2021. TOH Parking Garage Facility Proximity Study Preliminary Report
Parsons. August 2021. Environmental Impact Statement and Tree Conservation Report – Master Site Plan	Golder. December 2021. Phase 2 Environmental Site Assessment, Ottawa Hospital New Civic Campus Parkade
Golder. July 2021. Cultural Heritage Impact Statement – New Civic Development for the Ottawa Hospital, Carling Avenue at Prince of Wales Drive and Preston Street, City of Ottawa Ontario	Golder. December 2021. Geotechnical and Hydrogeological Investigation. New Ottawa Hospital Development, Phase 2 - New Parkade Structure.
Golder. March 2021. Phase one Environmental Site Assessment - The New Ottawa Hospital – New Civic Campus	Golder. November 2021. Addendum: Cultural Heritage Impact Statement for the New Civic Development for the Ottawa Hospital, Carling Avenue at Prince of Wales Drive and Preston Street, City of Ottawa, Ontario
Golder. March 2021. Preliminary Geotechnical Overview, Ottawa Hospital.	HDR. June 2022. Site Plan Control Drawings
Golder. November 2020. Stage 1 Archaeological Assessment. Ottawa Hospital, Part of Lots I & K, Broken Front B Geographic Township of Nepean, City of Ottawa, Ontario	Parsons. March 2022. New Civic Development Phase 2 Project: Parking Garage and Green Roof Environmental Effects Analysis/Environmental Impact Statement and Tree Conservation Report Update
Golder. December 2021. Stage 2 Archaeological Assessment, Ottawa Hospital, Part of Lots I & K, Broken Front B, Geographic Township of Nepean, City of Ottawa, Ontario	Parsons. June 2022. Site Servicing and Stormwater Report. The New Civic Development - The Ottawa Hospital Phase 2 Parking Garage Development and associated drawings.
Gradient Wind. April 2021. Pedestrian Level Wind Study, The Ottawa Hospital New Civic Development, Ottawa Ontario	
Gradient Wind. May 2021. Environmental Noise and Vibration Assessment, 930 Carling Avenue and 520 Preston Street Ottawa, Ontario	
HDR. August 2021. Site Plan Control Drawing Package, Master Site Plan.	

2.0 PROPOSED TEMPORARY BERM

The removal of the Sir John Carling Building and Annex and its associated infrastructure (south parking area), resulted in new overland flow routes down the escarpment, whereas stormwater was previously collected and diverted to the Dow's Lake outlet that generally services the top escarpment lands. This current condition has resulted in the oversaturating and some erosion of the wooded escarpment since the removal of the building and the associated storm collection infrastructure. While this condition will be resolved as part of the main Hospital building, prior to final grading and pavement of Road A and B, a temporary berm will be required at the top of the wooded escarpment on the southwest end, to divert overland flow to the storm catchment system along Carling Avenue (Nepean Bay Trunk) to ensure that this overland flow does not overflow onto Prince of Wales Drive. A catchbasin within the northwest drainage area with the Phase 2 Project Area will capture the flow and release it at a controlled rate to the existing storm sewer in Carling Avenue that ultimately outlets to the Nepean Bay Trunk.The location of the proposed Temporary Berm in context to the Phase 2 and overall TOH site is illustrated in **Figure 2**.

Figure 2: Location of Proposed Temporary Berm



2.1 Temporary Berm Project Components

The construction of the Temporary Berm is expected to take place prior to final grading and paving of Roads A and B (located within the Phase 2 Project Area) and is expected to include the following activities:

- Survey and field layout of limit of works, confirmation of tree removals;
- Installation of construction fencing/tree protection including placement of coir mats;
- Grubbing and tree removals (based on result of field confirmations);
- Grading and sloping;
- Placement of rip/rap and fill material;
- Application of seed mixture; and
- Demobilization.

Access to construct the Temporary Berm would be provided via the access used for on-going site remediation activities associated with the Sir John Carling building and Annex. The location and general layout of the Temporary Berm is illustrated in **Figure 3**. The Temporary Berm is approximately 1.8 metres wide (including the flow area and berm) and 0.45 metres high as illustrated in **Figure 4**.

Figure 3: Temporary Berm - Engineering Design

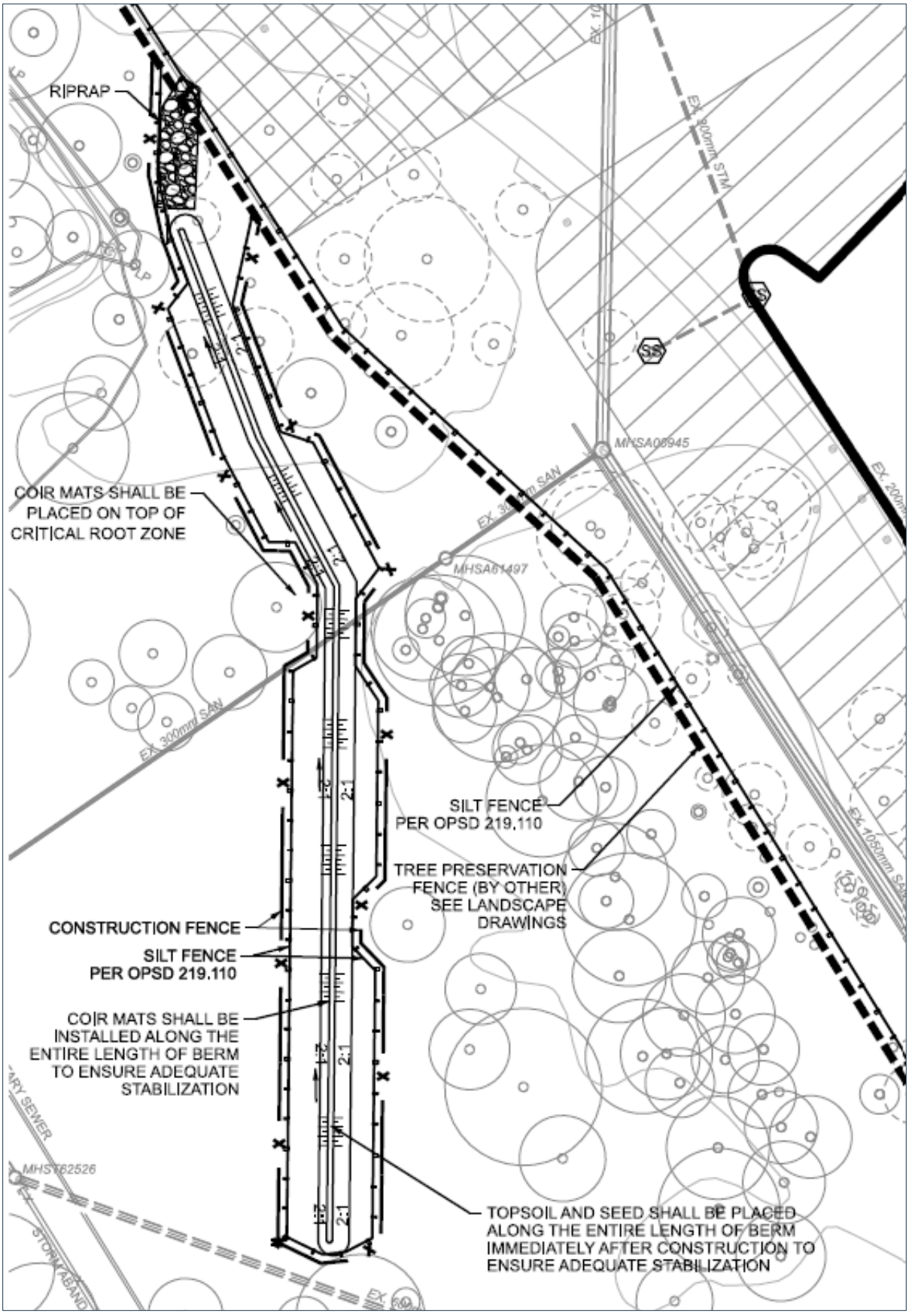
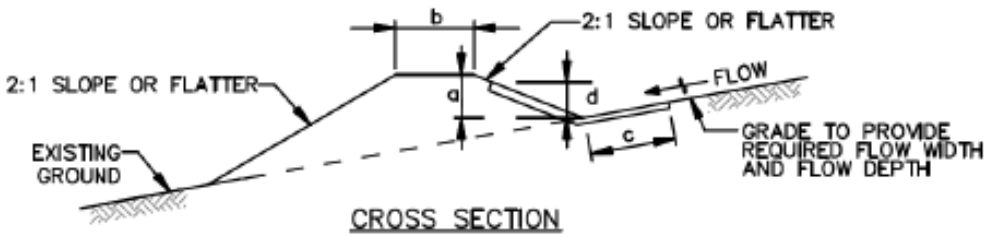


Figure 4: Temporary Berm - Engineering Detail

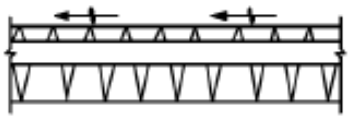
DETAIL C-1 EARTH DIKE

STANDARD SYMBOL
A–1
PLACE DESIGNATION (e.g. A–1) ON FLOW CHANNEL SIDE OF DIKE.



CROSS SECTION

CONTINUOUS GRADE
0.5% MIN. TO 10% MAX. SLOPE



PLAN VIEW

DIKE TYPE

	A	B
a – DIKE HEIGHT	0.45m MIN.	30 IN MIN.
b – DIKE WIDTH	0.60m MIN.	36 IN MIN.
c – FLOW WIDTH	1.20m MIN.	6 FT MIN.
d – FLOW DEPTH	0.30m MIN.	24 IN MIN.

FLOW CHANNEL STABILIZATION

A–1	SEED WITH STRAW MULCH AND TACK. (NOT ALLOWED FOR CLEAR WATER DIVERSION.)
A–2/B–2	SEED WITH SOIL STABILIZATION MATTING OR LINE WITH SOD.
A–3/B–3	4 TO 7 INCH STONE OR EQUIVALENT RECYCLED CONCRETE PRESSED INTO SOIL A MINIMUM OF 7 INCHES AND FLUSH WITH GROUND.

CONSTRUCTION SPECIFICATIONS

1. REMOVE AND DISPOSE OF ALL TREES, BRUSH, STUMPS, OBSTRUCTIONS, AND OTHER OBJECTIONABLE MATERIAL SO AS NOT TO INTERFERE WITH PROPER FUNCTION OF EARTHDIKE.
2. EXCAVATE OR SHAPE EARTH DIKE TO LINE, GRADE, AND CROSS SECTION AS SPECIFIED. BANK PROJECTIONS OR OTHER IRREGULARITIES ARE NOT ALLOWED.
3. COMPACT FILL.
4. CONSTRUCT FLOW CHANNEL ON AN UNINTERRUPTED, CONTINUOUS GRADE, ADJUSTING THE LOCATION DUE TO FIELD CONDITIONS AS NECESSARY TO MAINTAIN POSITIVE DRAINAGE.
5. PROVIDE OUTLET PROTECTION AS REQUIRED ON APPROVED PLAN.
6. STABILIZE EARTH DIKE WITHIN THREE DAYS OF INSTALLATION. STABILIZE FLOW CHANNEL FOR CLEAR WATER DIVERSION WITHIN 24 HOURS OF INSTALLATION.
7. MAINTAIN LINE, GRADE, AND CROSS SECTION. REMOVE ACCUMULATED SEDIMENT AND DEBRIS, AND MAINTAIN POSITIVE DRAINAGE. KEEP EARTH DIKE AND POINT OF DISCHARGE FREE OF EROSION, AND CONTINUOUSLY MEET REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT IN ACCORDANCE WITH SECTION B–4 VEGETATIVE STABILIZATION.
8. UPON REMOVAL OF EARTH DIKE, GRADE AREA FLUSH WITH EXISTING GROUND. WITHIN 24 HOURS OF REMOVAL STABILIZE DISTURBED AREA WITH TOPSOIL, SEED, AND MULCH, OR AS SPECIFIED ON APPROVED PLAN.

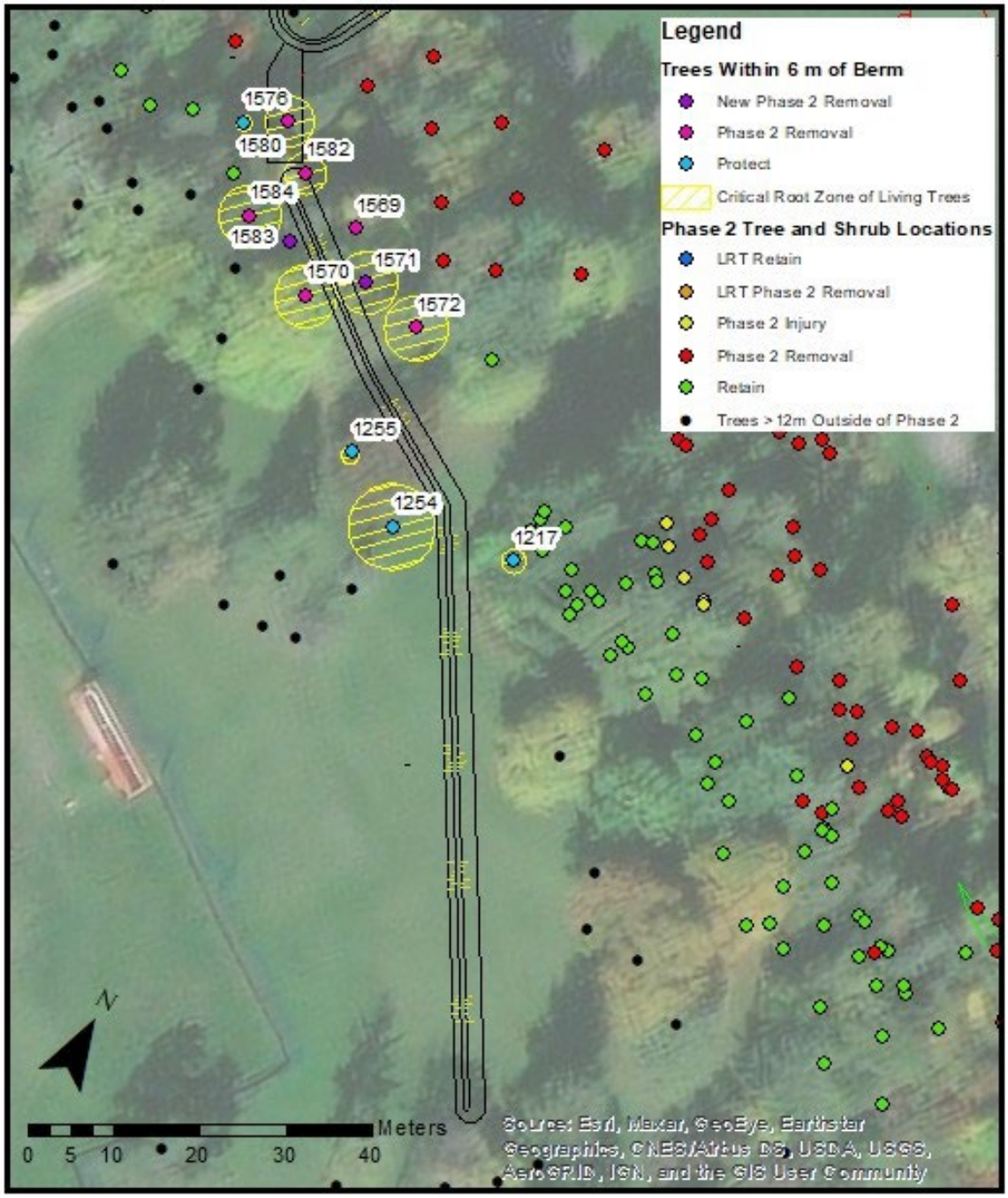
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

The Temporary Berm features will result in the removal of two additional trees (above 10 DBH) beyond the Phase 2 area as illustrated in **Figure 5** and as noted in **Table 6**. Additional notes related to tree inventory include:

- Tree #1583 is a new removal however less than 10 cm dbh and is a European Buckthorn;
- Tree #1580 was identified as a removal as part of the Phase 2 Project;
- Tree #1582 was identified as a removal as part of the Phase 2 Project;
- Tree #1571 was identified as an injury as part of the Phase 2 Project and removal as part of Phase 4;
- Tree #1570 is a new removal and is a Red Pine in fair condition; and
- Tree #1969 is a dead green ash tree, not impacted by the temporary berm feature, however, is identified as a Phase 2 removal.

Figure 5: Temporary Berm - Tree Removals



2.2 Supplemental Site Conditions

The following description augments the existing conditions already described in the Environmental Impact Statement and Tree Conservation Report – Master Site Plan, prepared for New Civic Development (Hospital Leased Area) and the signed Environmental Effects Analysis/Environmental Impact Statement and Tree Conservation Report Update for the Phase 2 Project Area and supplements the information that was provided in the original reports.

The existing conditions of the footprint of the Temporary Berm includes a heavily manicured landscape including manicured lawn and planted trees. The berm is positioned at the top of a partially treed slope, with the northern end of the berm located within the treed area, and the southern portion of the berm within the open manicured lawn. The slope is bisected by an open, grassy strip, approximately 15 m wide, which was observed to have high levels of surface water flow during storm events. It has been noted that these surface flow conditions are a direct result of the demolition of the former Sir John Carling Building, which would have redirected water away from this slope.

Trees located at the crest of the slope are primarily planted upland conifer species, including Norway Spruce (*Picea abies*) and White Spruce (*Picea glauca*), with occasional Eastern White Pine (*Pinus strobus*) and Red Pine (*Pinus resinosa*). Younger, naturally occurring trees along the slope are dominated by disturbance-tolerant Manitoba Maple (*Acer negundo*) and Green Ash (*Fraxinus pennsylvanica*), however ash trees are primarily in poor to dead condition due to Emerald Ash Borer infestation. Additionally, heavy invasive species cover of European Buckthorn (*Rhamnus cathartica*) and Dog-Strangling Vine (*Cynanchum rossicum*) were observed.

A total of 9 trees over 10 cm diameter at breast height (DBH) are located within 6m of the limits of the berm, with removal of 3 trees and 1 invasive shrub required for the construction of the berm. All impacted trees are recommended for removal as part of the berm construction, and were identified for removal at the Master Site Plan stage due to conflict with Road A.

Table 2: Tree Inventory Update

Tree ID #	Common Name	Taxonomic Name	DBH	Condition	Master Site Plan Action	Phase 2 Addendum Action
1217	Green Ash	*Fraxinus pennsylvanica*	14	Good	Retain	Protect
1254	Silver Maple	*Acer saccharinum*	48	Good	Retain	Protect
1255	Unknown	n/a	10	Poor	Retain	Protect
1569	**Green Ash**	***Fraxinus pennsylvanica***	**28**	**Dead**	**Remove (Phase 2)**	**Remove**
1570	**Red Pine**	***Pinus resinosa***	**36**	**Fair**	**Remove**	**Remove**
1571	**White Spruce**	***Picea glauca***	**36**	**Fair**	**Remove (Phase 4)**	**Remove**
1572	Red Pine	*Pinus resinosa*	37	Fair	Remove	Protect
1576	Green Ash	*Fraxinus pennsylvanica*	9	Poor	Retain	Protect
1580	**Red Pine**	*Pinus resinosa*	**29**	**Fair**	**Remove (Phase 2)**	**Remove**
1582	**Manitoba Maple**	***Acer negundo***	**24**	**Fair**	**Remove (Phase 2)**	**Remove**
1583	**European Buckthorn**	***Rhamnus cathartica***	**8**	**Fair**	**Remove (Phase 4)**	**Remove**
1584	Red Pine	*Pinus resinosa*	36	Poor	Remove	Protect

A portion of the berm area is located with the area of remediation activities associated with the Sir John Carling Building where shallow service soil contamination has been identified. This area is to be remediated during summer 2022 and prior to the installation of the Temporary Berm. As such interaction with contaminated soils is not anticipated as part construction activities associated with the temporary berm feature.

2.3 Environmental Effects

This section identifies the potential environmental interactions by category specific to the Temporary Berm identified since the original report, based on the known and predicted effects (**Table 3 - Table 7**). Where an interaction has been identified, an assessment of the environmental effect, as well as proposed mitigation has been described (**Table 8**).

Table 3: Biophysical Effects

Does the project have the potential to:	NO	Yes, and can be managed through Effective and Established Mitigation Measures	Yes, but must be managed through other Mitigation Measures
Harmfully alter, disturb, or destroy vulnerable natural features?	✓		
Release a polluting substance into the land, water, or air?		✓	
Alter landscape features (e.g. resource extraction, deforestation, clearing of vegetation)?		✓	
Affect birds and wildlife (flora and fauna), including species at risk and its critical habitat?		✓	
Result in alteration of water level, quality, flow or management regime in a water body, or result in other changes to surface or groundwater resources (including well-water)?		✓	
Cause sensory disturbances, such as noise and/or vibrations?		✓	
Cause any other change to the environment on federal lands or incidental to a federal decision? If so, define:	✓		

Table 4: Socio-economic Effects (Indigenous Rights)

Does the project have the potential to result in changes to the environment that may affect Indigenous Peoples, specifically?	NO	Yes, and can be managed through Effective and Established Mitigation	Yes, but must be managed through Other Mitigation Measures
Social, economic, and health conditions (e.g. impact to an Indigenous fishery resulting from a change in fish population)	✓		
Physical and cultural heritage, use of lands and resources for traditional purposes, or anything of historical, archaeological, paleontological, or architectural significance	✓		
Indigenous culture	✓		
Indigenous knowledge	✓		

Table 5: Socio-economic Effects (Health)

Does the project have the potential to result in changes to the environment that may affect the following health factors:	NO	Yes, and can be managed through Effective and Established Mitigation	Yes, but must be managed through Other Mitigation Measures
Human Health		✓	

Table 6: Socio-Economic Effects (Social)

Does the project have the potential to result in changes to the environment that may affect the following social factors?	NO	Yes, and can be managed through Effective and Established Mitigation	Yes, but must be managed through Other Mitigation
Services and infrastructure	✓		
Land and resource use and recreation	✓		
Navigation	✓		
Community well-being	✓		
Structure, site, things of historical, archaeological, paleontological or architectural significance	✓		

Table 7: Socio-Economic Effects (Economic)

Does the project have the potential to result in changes to the environment that may affect the following economic factors:	NO	Yes, and can be managed through Effective and Established Mitigation	Yes, but must be managed through Other Mitigation
Economic conditions and livelihoods (e.g., impact to agriculture from a change in livestock health and productivity)	✓		

2.4 Established and Effective Mitigation Measures

The assessment of potential additional effects and recommended mitigation measures is provided in **Table 8** below. It is anticipated that the potential environmental effects associated with this project are common and predicable and can be managed with effective and established mitigation as outlined below.

Table 8: Potential Impacts and Mitigation

Environmental Effect	*Activity	*B.P	*S.E	Effective and Established Mitigation Measures	Residual Effect	Monitoring
Release a polluting substance into the land, water, or air						
a) Disturbed or stockpiled materials may be eroded during rainfall events.	C	X		• Implement Erosion and Sediment Control Plan. • Store stockpiled material away from the watercourses and steep slopes. • If material is stored for prolonged periods, it should be tarped, or otherwise stabilized, to prevent erosion. • All surplus stockpiled material should be removed following construction. • See below mitigation b, *Release a polluting substance into the land, water, or air.*	• No anticipated negative residual effects following the implementation of mitigation.	• Monitoring of ESC measures.

Environmental Effect	*Activity	*B.P	*S.E	Effective and Established Mitigation Measures	Residual Effect	Monitoring
b) Grubbing activities may increase the risk of erosion.	C	X		• Implement Erosion and Sediment Control Plan. • All exposed soil following the completion of the construction works shall be stabilized as soon as possible. • Stockpiled material shall be stored away from watercourse and embankments. Silt fencing shall encompass stockpiled materials. • Prior to removal of Erosion and Sediment Control measures, all silt and sediment captured shall be removed.	• No anticipated negative residual effects following the implementation of mitigation.	• Monitoring of ESC measures to be carried out by a Certified Inspector of Sediment and Erosion Control (CISEC).
c) There is the potential for spills/leaks from equipment during construction and may result in the degradation of surface water / groundwater quality.	C	X		• Implement Environmental Protection Plan and Spill Response and Action Plan. The proponent shall provide PSPC and the NCC with a copy of the Environmental Protection Plan (at least 10 business days) prior to construction commencement • All machinery shall be in good working condition free of fluid leaks. Daily inspections shall be conducted to ensure this. • Activities including refueling, oil changes, and machinery lubrications are not permitted within 30m of the watercourse. A designated refueling area shall be implemented for the site. • The contractor will be responsible for keeping a Spill Kit on site during the entire duration of the works. • In the event of an accidental spill, the contractor will be responsible for containing, cleaning out and disposing the contaminants caused by the spill in accordance with existing regulations. Contractor will also report any spill on PSPC property to Darragh Kilroy, Environmental Specialist (613-736-3222 / Darragh.kilroy@tpsgc-pwgsc.gc.ca).	• No anticipated negative residual effects following the implementation of mitigation.	• None required.

Environmental Effect	*Activity	*B.P	*S.E	Effective and Established Mitigation Measures	Residual Effect	Monitoring
d) Air quality degradation through dust and particulate emissions arising from construction activities and the operation of machinery.	C		X (H)	• The effects on air quality from construction activities are generally controlled by good construction practice and proper equipment function. To further avoid or reduce the potential for decreased ambient air quality from project activities, the following where appropriate, may be required during construction: • Minimize vehicle traffic on exposed soils. • Stabilize soil and other material storage piles against wind erosion. • Equipment to be kept in good working order and will not unnecessarily idle. • Dust suppressants will be applied as warranted. • Cover and contain fine particulate materials during transportation to and from the site. • Locate storage piles in sheltered areas if feasible. • Provide moveable windbreaks if feasible. • Use new or well-maintained heavy equipment and machinery, preferably fitted with fully functional emission control systems/ muffler/ exhaust system baffles and engine covers. • Select appropriately sized equipment for the job. • Avoid unnecessary idling.	• No anticipated residual effect following the implementation of mitigation.	• Monitor complaints during construction.
Alter landscape features						
a) Addition of grading/fill requires the removal of 2 trees (above 10 DBH not originally identified as part of Phase 2 Project).	C	X		• Implement Vegetation Management/ Conservation Strategy and Contractor Education Program. • Seeding of Berm with native soil mixture. • Implement Tree Protection (construction fencing) as noted on C001 – Erosion and Sediment Control Plan Phase 2 Site Plan.	• None Anticipated	• Monitor health of proximate trees throughout ongoing phases of development and as part of post-construction monitoring.

Environmental Effect	*Activity	*B.P	*S.E	Effective and Established Mitigation Measures	Residual Effect	Monitoring
b) Heavy equipment brought to the site may inadvertently bring and spread non-native plants and seeds.	C	X		• Heavy equipment must be cleaned and free of invasive species prior to entering and before leaving the construction site. Best Management Practices from the Invasive Ontario Plant Council (www.ontarioinvasiveplants.ca) should be applied to prevent the spreading of invasive species into and from federal property. The Ontario Clean Equipment Protocol can be found at (https://www.ontarioinvasiveplants.ca/wp-content/uploads/2016/07/Clean-Equipment-Protocol_June2016_D3_WEB-1.pdf).	• No anticipated negative residual effects following the implementation of mitigation.	• None required.
Affect birds, wildlife, and fish including Species at Risk						
a) Limited potential for Species at Risk to be encountered during the project works, with limited potential for turtles to cross into the project area in search of nesting habitat. b) Some potential for urban wildlife to be incidentally encountered during project works.	C	X		• Construction workers should be aware of the City of Ottawa Protocol for Wildlife Protection during Construction (August 2015). • Erosion and Sediment Control Fencing will be installed around the construction area before the commencement of construction activities. • The contractor must perform daily pre-work searches of the construction area to ensure no wildlife have entered the work area overnight. • Secure stockpiled materials, vehicles, and structures against wildlife entry. • Litter and other waste materials must be appropriately contained and disposed of. • Do not feed any wildlife or leave food out where it could attract them.	• No anticipated negative residual effects following the implementation of mitigation.	• None Required.
c) Disturbed or stockpiled materials may be eroded during rainfall events may flow into storm sewers and into watercourses delivering sediment into the aquatic environment.	C		X	• See mitigation a, b and c *Release a polluting substance into the land, water, or air.*	• No anticipated residual effect following the implementation of mitigation.	• Monitoring of ESC measures.
d) Butternut was identified approximately 100 m of the additional works and is not anticipated to be impacted as part of the proposed work.	C	X		• Any anticipated removal of or damage to Butternut must follow the requirements the Federal Species at Risk Act, 2002. This will include a permit issued under Section 73 of SARA.	• No impact to butternut is anticipated as part of the proposed work.	• None Required.

Environmental Effect	*Activity	*B.P	*S.E	Effective and Established Mitigation Measures	Residual Effect	Monitoring
Result in alteration of water level, quality, flow or management regime in a waterbody or result in other changes to surface resources						
a) Removal of Sir John Carling Building and associated parking and stormwater management infrastructure resulted in redirecting overland flow over the wooded escarpment that was previously designed to the outlet to Dow's Lake.	C, O	X		• Construction of temporary berm to redirect stormwater away from natural features to storm municipal collection system.	• Positive impact on existing upland treed escarpment that is currently experiencing some decline due to increased stormwater.	• Monitor health of trees as per *Alter landscape features)*
Cause sensory disturbances, such as noise and/or vibrations						
a) Construction activities associated with the project may cause sensory disturbances to adjacent uses.	C		X	• Temporary impacts are anticipated to be short-term in duration and insignificant in magnitude, restricted to the project construction phase. • Contractor to adhere to the City By-laws (2017-255). • Keeping equipment well maintained, moving parts lubricated and restricting unnecessary idling. • Compliance with MECP NPC-115 and NPC-118.	• Temporary disturbance during construction.	• Monitor complaints during construction.

***B.P: Biophysical Effect, S.E: Socio-economic Effects (Indigenous rights (I.R.), and/or health (H), social (S) economic (E))**

***Activity: Site preparation / Construction (C), Operation (O)**

2.5 Determination

Taking into account implementation of mitigation measures outlined in the analysis, this temporary berm is:

☑	**Not likely to cause significant adverse environmental effects**
☐	**Likely to cause significant adverse environmental effects**

3.0 PARKING GARAGE LIFE CYCLE ASSESSMENT

The Parking Garage and Green Roof Project provides the majority of the required vehicle parking for the new Civic development but also acts as a hub for active transportation and provides outdoor public open space. An assessment of greenhouse gases was not available at the time of the original report as the project was continuing towards developed design. With these additional details, HDR (2022) completed a Carbon Intensity Analysis (included as **Appendix B**) to better understand the main sources of emissions, inform elements to be built into the design to reduce carbon emissions and other considerations through construction.

As noted in the report, the analysis was based on assessing building materials using an industry-accepted Life Cycle Assessment computer modelling tool for whole-building analysis. The analysis paid specific attention to the *Treasury Board's Greening Government Strategy: A Government of Canada Directive* which requires the reduction of "the embodied carbon of the structural materials by 30%" and Environment and Climate Change Canada's quantification of net greenhouse gas emissions.

Based on the analysis and in consultation with local suppliers, the specification of a 30% reduction in embodied carbon in the structure is feasible however it is expected that 40% reduction is possible once product specifications are finalized.

4.0 UPDATED REVIEW OF CUMULATIVE EFFECTS

Cumulative effects are residual effects on the environment combined with the environmental effects of past, present and future projects or activities. Cumulative effects can also result from the combination of different individual environmental effects of the project, acting on the same environmental component.

At the Master Site Plan Stage, a number of studies were prepared to identify possible environmental constraints and identify potential impacts to be studied as detailed phases were brought forth for approval. These included:

- Environmental Impact Statement and Tree Conservation Report – Master Site Plan
- Transportation Impact Statement and Assessment and Mobility Study
- Cultural Heritage Impact Statement
- Phase I Environmental Site Assessment
- Pedestrian Level Wind Study
- Environmental Noise and Vibration Assessment
- Geotechnical Review
- Master Servicing Report

The detailed Environmental Effects Analysis/Environmental Impact Statement and Tree Conservation Report Update was prepared to review the Phase 2 Project and identified required mitigation measures to avoid or reduce potential envrionmental effects of the project. The report also identified residual effects. As an update, a review of cummulative effects was completed to identify any additional mitigation measures that might be required.

Detailed Impact Assessments through Environmental Effects Analysis are required for each subsequent phase of the NCD project as per the Federal Lands Use Approval conditions granted during the Master Site Plan process. Further analysis and detailed studies will be undertaken, and mitigations developed which can be carried forward for any future Cumulative Effects reviews required for the NCD site.

While there are spatial and temporal interactions from past, present and future projects occurring on the NCD site, master site planning has had the result that negative impacts that are anticipated will have an insignificant cumulative effect and that an overall cumulative positive net-benefit is anticipated.

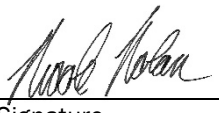
The complete updated review of cumulative effects is provided as **Appendix C**.

SECTION C: CONSULTATION AND ENGAGEMENT

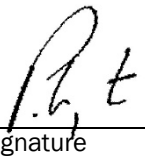
Consultation and Engagement is an important component of the Federal Impact Assessment process as well as the planning of the NCD site. Significant consultation has been undertaken with many interested parties, including the public, indigenous peoples and experts from other jurisdictions as outlined in the EEA/EIS and TCR Update. Updates on consultation activities since the signing of the original report are attached as **Appendix D**: Consultation Summary, June 2022.

SECTION D: SIGN-OFF AND APPROVAL

Completed by:

Nicole Nolan Ecologist Parsons Inc.	 Signature	June 22, 2022 Date
Brandon Jarvis Senior Environmental Planner Parsons Inc.	 Signature	June 22, 2022 Date

Reviewed by:

Pam Whyte MCIP, RPP Manager of Planning, Ottawa Parsons Inc.	 Signature	June 22, 2022 Date

Sign-off and Approval:

Nicole Merkley Environmental Specialist Public Services and Procurement Canada	Signature	Date

Comments:

Isabelle Leclerc-Morin Chief, Environmental Impact Assessment National Capital Commission	Signature	Date

Comments:

Maya Moser

Environmental Officer
National Capital
Commission

Signature Date

Comments:

SECTION E: RESOURCES AND REFERENCES

Golder. November 2020. Stage 1 Archaeological Assessment. Ottawa Hospital, Part of Lots I & K, Broken Front B Geographic Township of Nepean, City of Ottawa, Ontario.

Golder. March 2021. Phase one Environmental Site Assessment - The New Ottawa Hospital – New Civic Campus.

Golder. March 2021. Preliminary Geotechnical Overview, Ottawa Hospital.

Golder. July 2021. Cultural Heritage Impact Statement – New Civic Development for the Ottawa Hospital, Carling Avenue at Prince of Wales Drive and Preston Street, City of Ottawa Ontario.

Golder. December 2021. Stage 2 Archaeological Assessment, Ottawa Hospital, Part of Lots I & K, Broken Front B, Geographic Township of Nepean, City of Ottawa, Ontario.

Golder. November 2021. Addendum: Cultural Heritage Impact Statement for the New Civic Development for the Ottawa Hospital, Carling Avenue at Prince of Wales Drive and Preston Street, City of Ottawa, Ontario.

Golder. December 2021. Geotechnical and Hydrogeological Investigation. New Ottawa Hospital Development, Phase 2 - New Parkade Structure.

Golder. December 2021. Phase 2 Environmental Site Assessment, Ottawa Hospital New Civic Campus Parkade.

Gradient Wind. April 2021. Pedestrian Level Wind Study, The Ottawa Hospital New Civic Development, Ottawa Ontario.

Gradient Wind. May 2021. Environmental Noise and Vibration Assessment, 930 Carling Avenue and 520 Preston Street Ottawa, Ontario.

HDR. June 2022. Site Plan Control Drawings.

HDR, June 2022. The Ottawa Hospital Parking Garage Life Cycle Assessment.

Parsons. March 2022. New Civic Development Phase 2 Parking Garage and Green Roof Environmental Effects Analysis/Environmental Impact Statement and Tree Conservation Report Update.

Parsons. August 2021. Design Brief and Planning Rationale – Master Site Plan. Applications for: Site Plan Control, Master Site Plans and Lifting of Holding Zone.

Parsons. July 2021. Transportation Impact Assessment and Mobility Study, New Civic Development for the Ottawa Hospital.

Parsons. July 2021. Master Servicing Plan, New Civic Development for the Ottawa Hospital.

Parsons. August 2021. Environmental Impact Statement and Tree Conservation Report – Master Site Plan.

Parsons. September 2021. TOH Parking Garage Facility Proximity Study Preliminary Report.

Parsons. January 2022. Design Brief and Planning Rationale. Application for Site Plan Control – Phase 2 Project, Parking Garage and associated drawings.

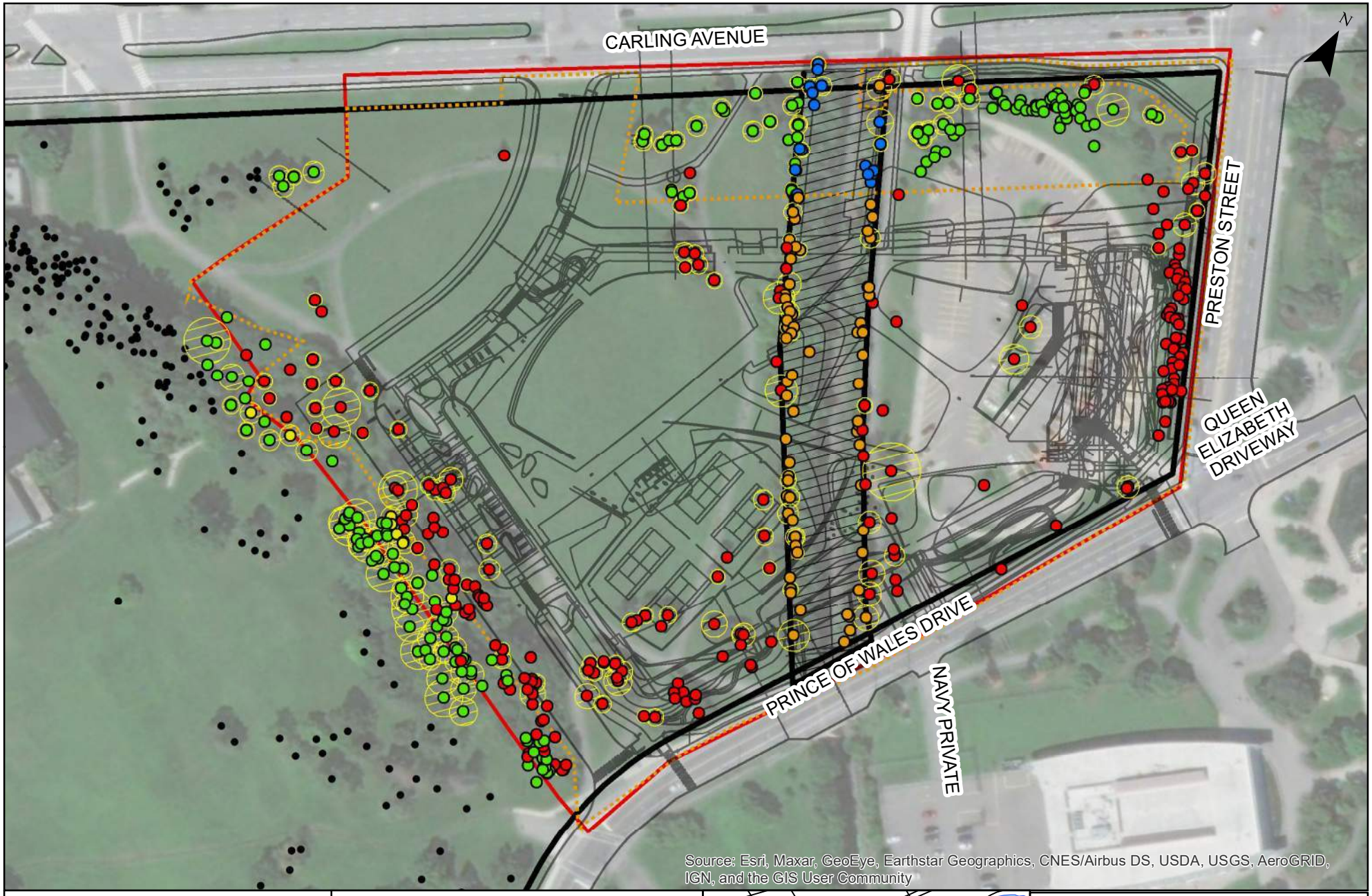
Parsons. February 2022. Transportation Impact Assessment, Addendum #1, New Civic Development for the Ottawa Hospital.

Parsons. March 2022. New Civic Development Phase 2 Project: Parking Garage and Green Roof Environmental Effects Analysis/Environmental Impact Statement and Tree Conservation Report Update.

Parsons. June 2022. Site Servicing and Stormwater Report. The New Civic Development - The Ottawa Hospital Phase 2 Parking Garage Development and associated drawing.

Parsons. June 2022. New Civic Development Phase 2 Project: Parking Garage and Green Roof – Review of Cumulative Effects.

APPENDIX A: TREE INVENTORY PHASE 2 PARKING GARAGE



0 10 20 40 60 80 Meters

PARSONS

Legend

- Phase 2 Project
- Construction Limits
- Ottawa Hospital Lease
- LRT Corridor
- Critical Root Zone of Living Trees
- Trees >12m Outside of Phase 2

Tree and Shrub Locations

- LRT Retain
- LRT Phase 2 Removal
- Phase 2 Injury
- Phase 2 Removal
- Retain

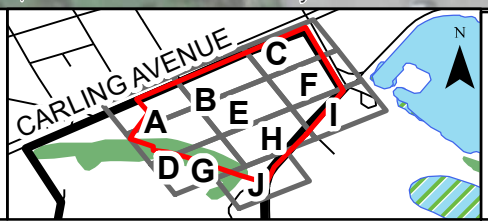


Figure 1

Tree Inventory Overview
The Ottawa Hospital
Phase 2 Parking Garage
Environmental Effects Analysis

Meters
0 2.75 5.5 11 16.5 22

PARSONS

Legend

- Phase 2 Project
- Construction Limits
- Ottawa Hospital Lease
- LRT Corridor
- Critical Root Zone of Living Trees
- Trees >12m Outside of Phase

Tree and Shrub

- LRT Retain
- LRT Phase 2 Removal
- Phase 2 Injury
- Phase 2 Removal
- Retain

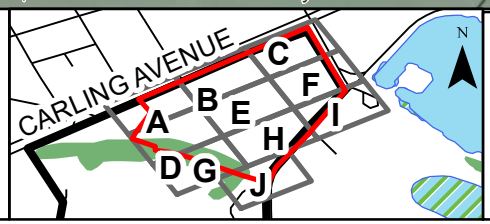
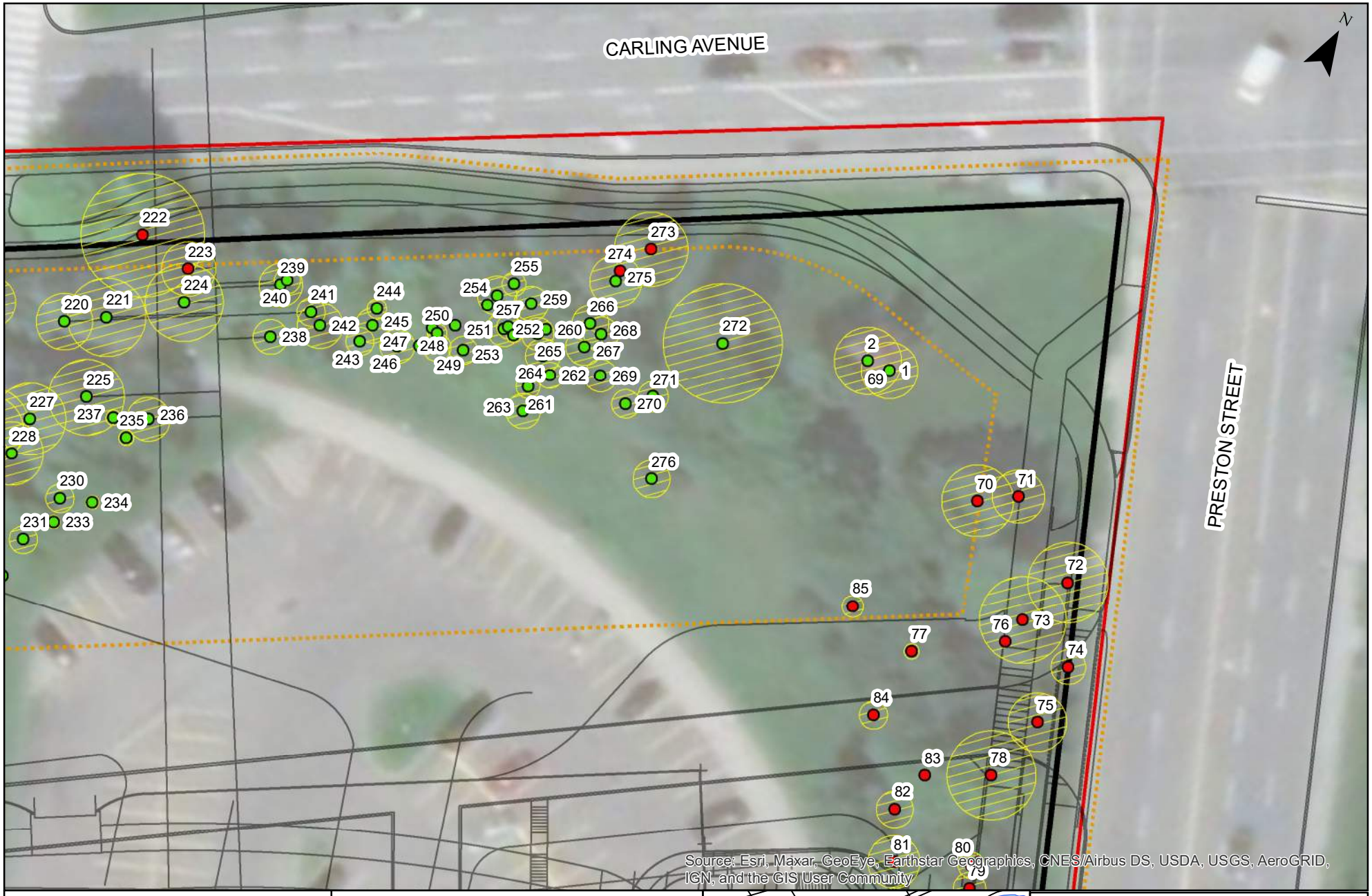


Figure 2A

Tree Inventory Overview
The Ottawa Hospital
Phase 2 Parking Garage
Environmental Effects Analysis

Figure 2B

Tree Inventory Overview
The Ottawa Hospital
Phase 2 Parking Garage
Environmental Effects Analysis



PARSONS

Figure 2 C

Tree Inventory Overview
The Ottawa Hospital
Phase 2 Parking Garage
Environmental Effects Analysis

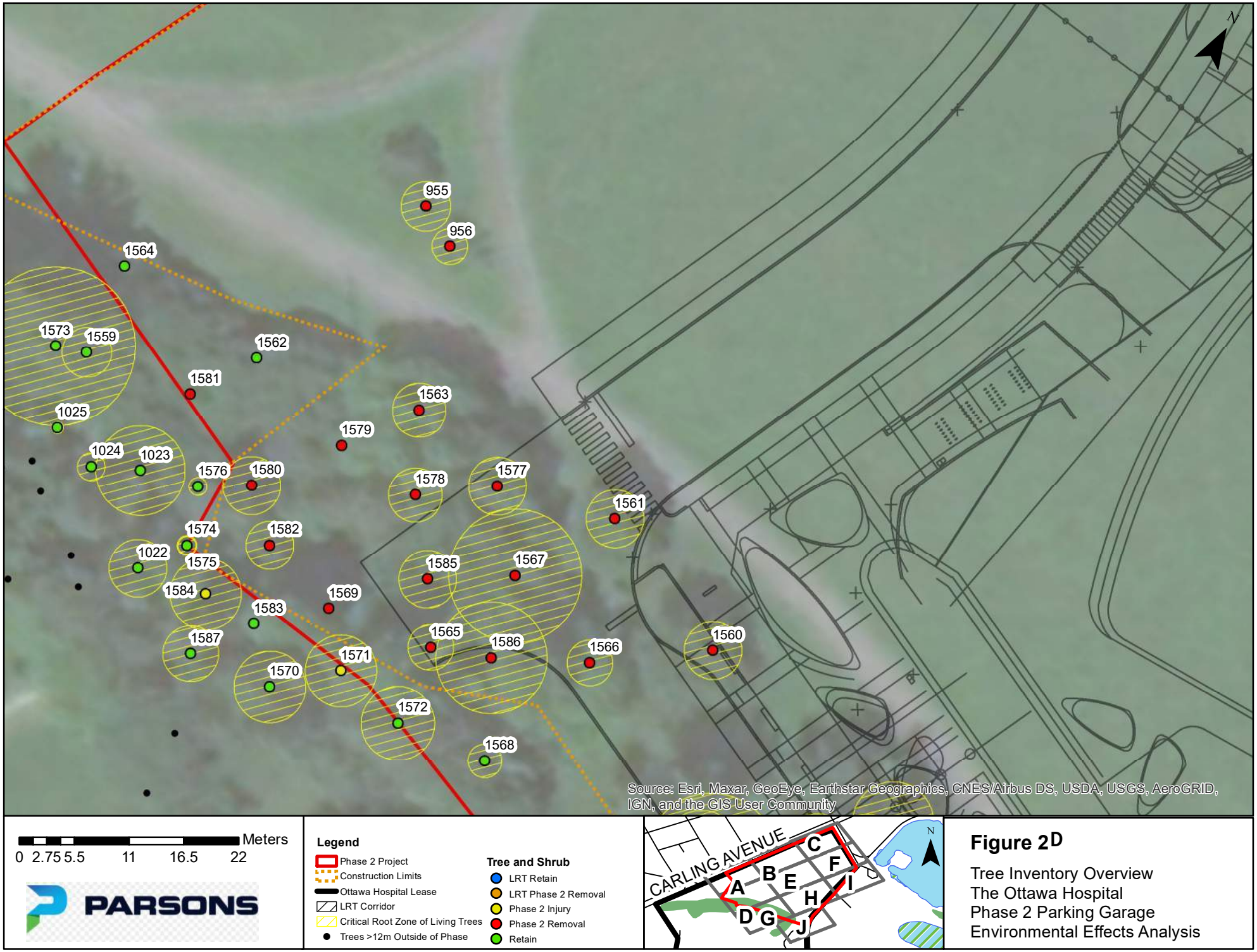
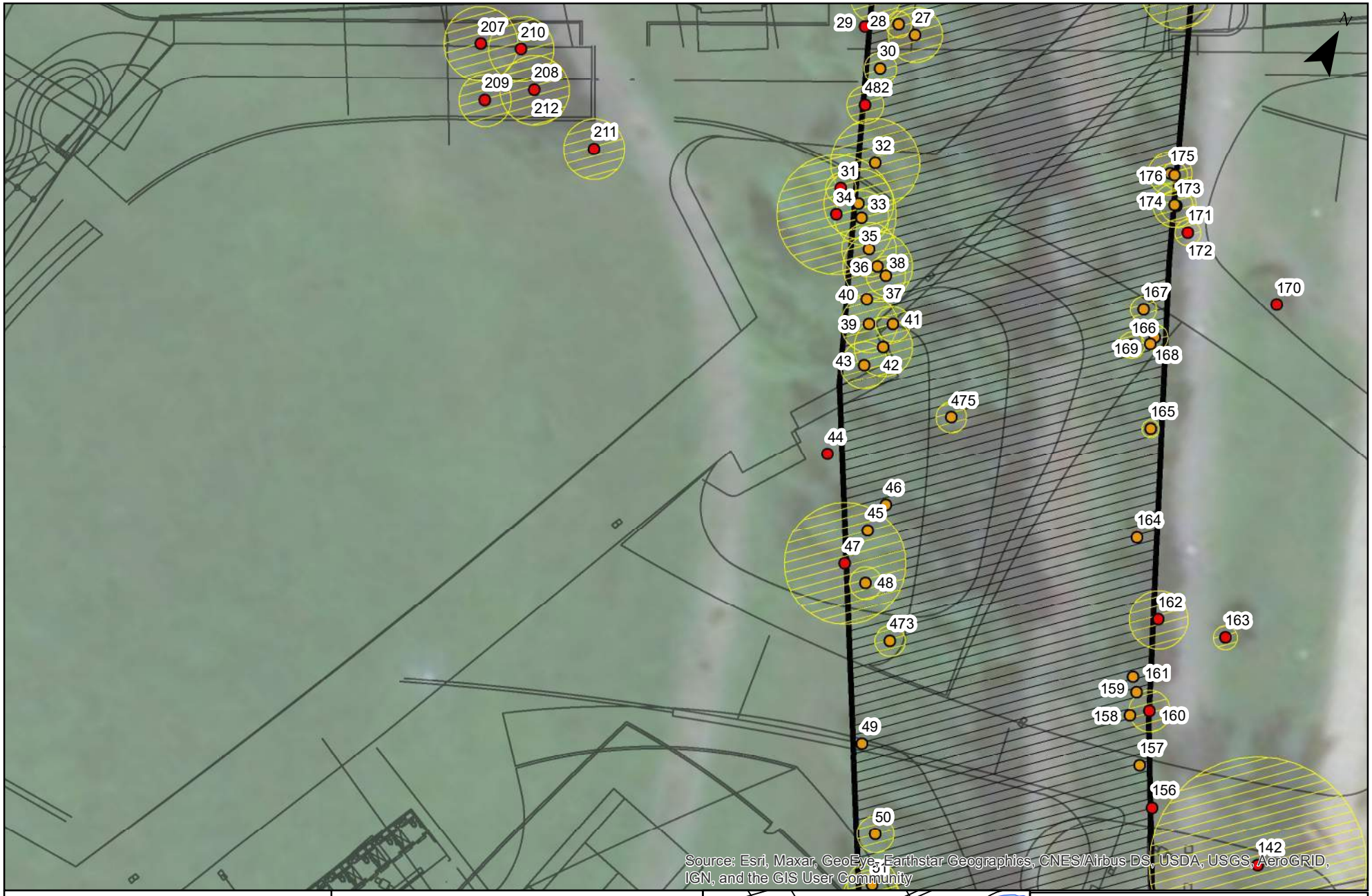


Figure 2D

Tree Inventory Overview
The Ottawa Hospital
Phase 2 Parking Garage
Environmental Effects Analysis



Meters
0 2.75 5.5 11 16.5 22

PARSONS

Legend

- Phase 2 Project
- Construction Limits
- Ottawa Hospital Lease
- LRT Corridor
- Critical Root Zone of Living Trees
- Trees >12m Outside of Phase

Tree and Shrub

- LRT Retain
- LRT Phase 2 Removal
- Phase 2 Injury
- Phase 2 Removal
- Retain

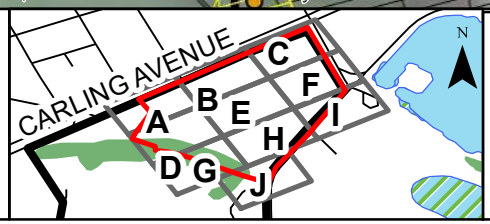


Figure 2E

Tree Inventory Overview
The Ottawa Hospital
Phase 2 Parking Garage
Environmental Effects Analysis

Meters
0 2.75 5.5 11 16.5 22

PARSONS

Legend

- Phase 2 Project
- Construction Limits
- Ottawa Hospital Lease
- LRT Corridor
- Critical Root Zone of Living Trees
- Trees >12m Outside of Phase

Tree and Shrub

- LRT Retain
- LRT Phase 2 Removal
- Phase 2 Injury
- Phase 2 Removal
- Retain

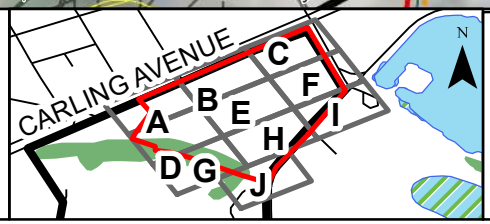
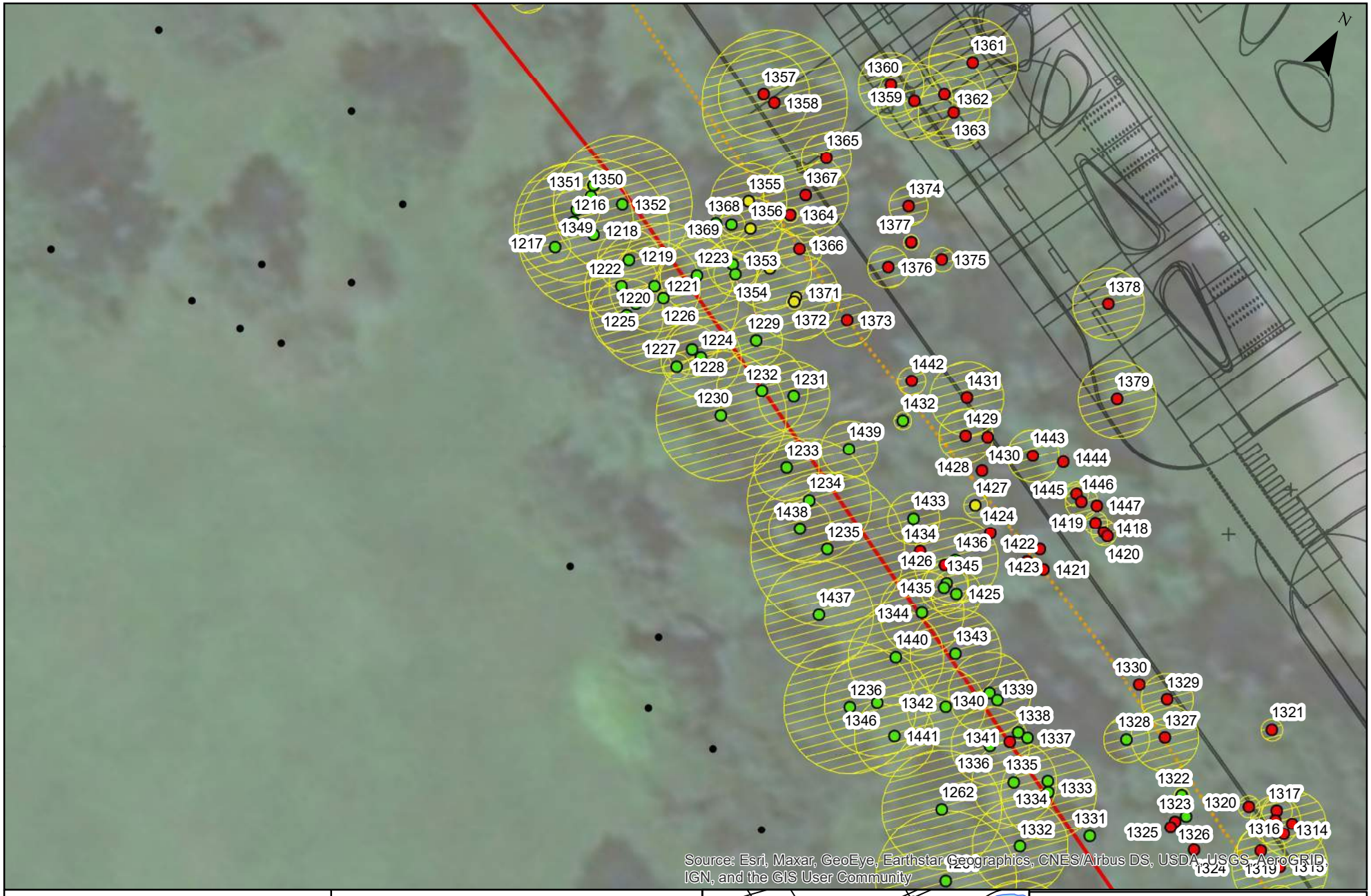


Figure 2F

Tree Inventory Overview
The Ottawa Hospital
Phase 2 Parking Garage
Environmental Effects Analysis



Meters
0 2.75 5.5 11 16.5 22

PARSONS

Legend

- Phase 2 Project
- Construction Limits
- Ottawa Hospital Lease
- LRT Corridor
- Critical Root Zone of Living Trees
- Trees >12m Outside of Phase

Tree and Shrub

- LRT Retain
- LRT Phase 2 Removal
- Phase 2 Injury
- Phase 2 Removal
- Retain

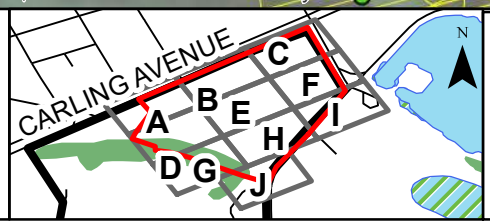


Figure 2G

Tree Inventory Overview
The Ottawa Hospital
Phase 2 Parking Garage
Environmental Effects Analysis

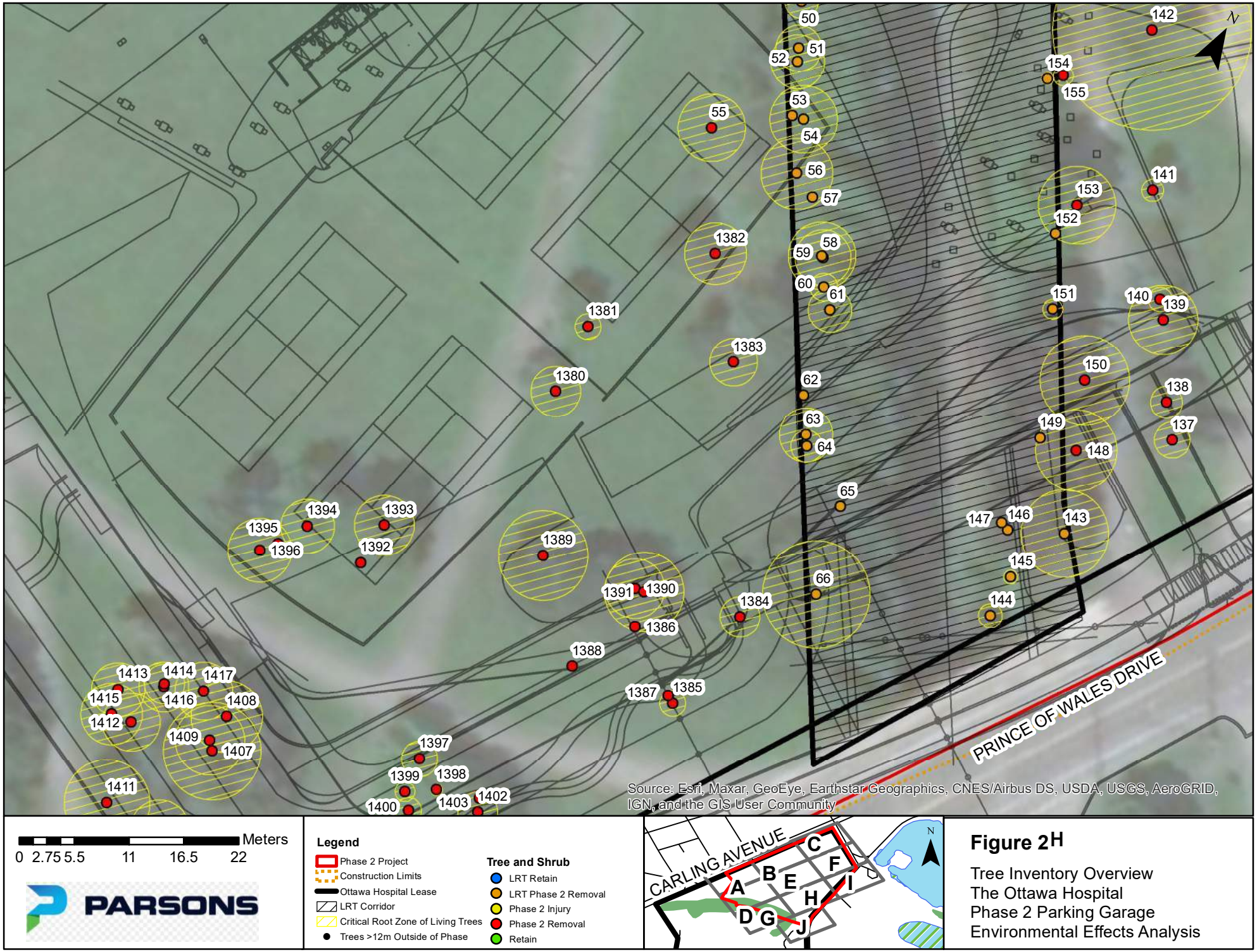


Figure 2H

Tree Inventory Overview
The Ottawa Hospital
Phase 2 Parking Garage
Environmental Effects Analysis

Meters
0 2.75 5.5 11 16.5 22

PARSONS

Legend

- Phase 2 Project
- Construction Limits
- Ottawa Hospital Lease
- LRT Corridor
- Critical Root Zone of Living Trees
- Trees >12m Outside of Phase

Tree and Shrub

- LRT Retain
- LRT Phase 2 Removal
- Phase 2 Injury
- Phase 2 Removal
- Retain

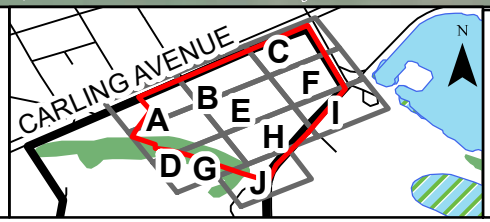


Figure 2I

Tree Inventory Overview
The Ottawa Hospital
Phase 2 Parking Garage
Environmental Effects Analysis

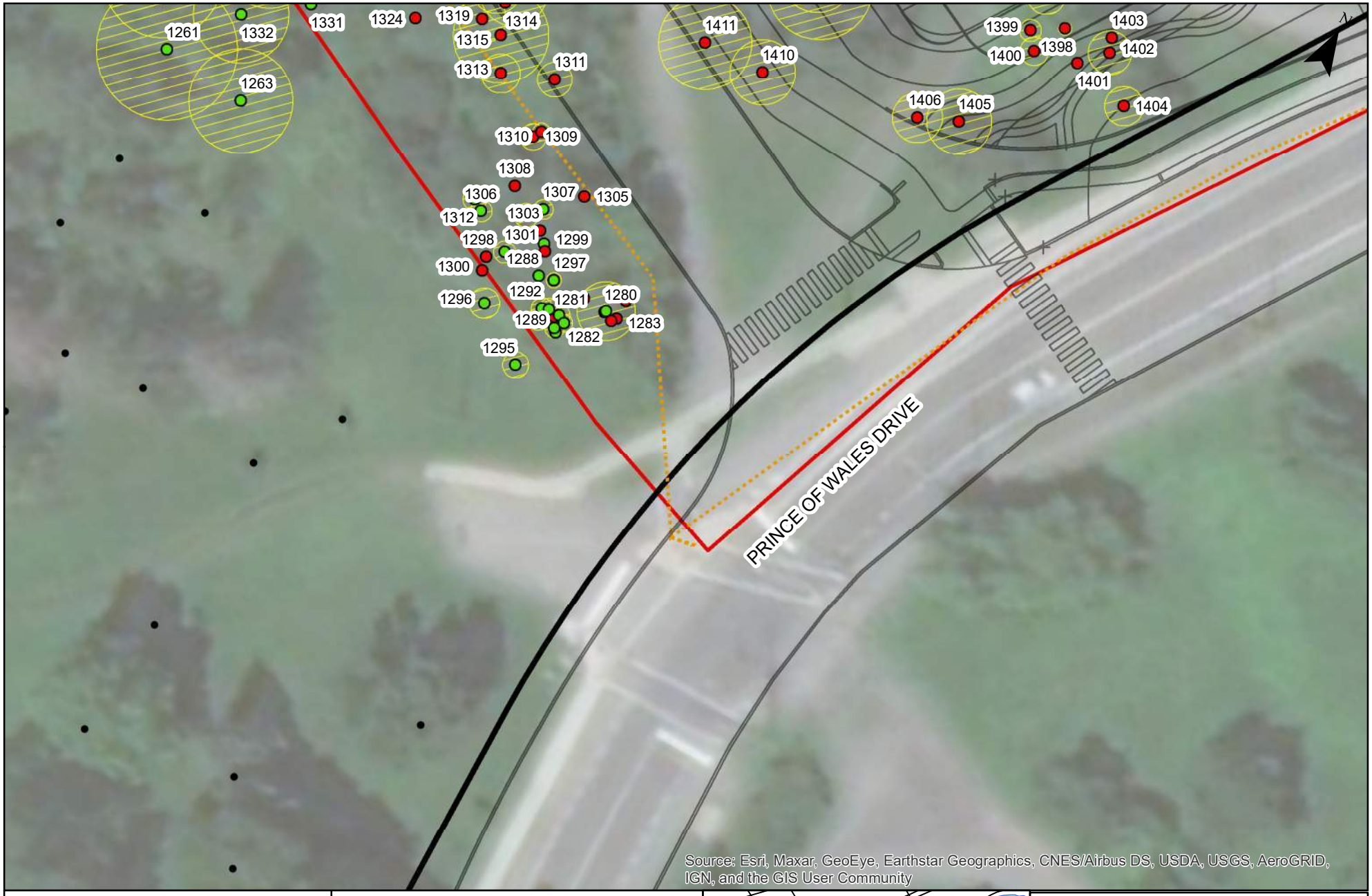
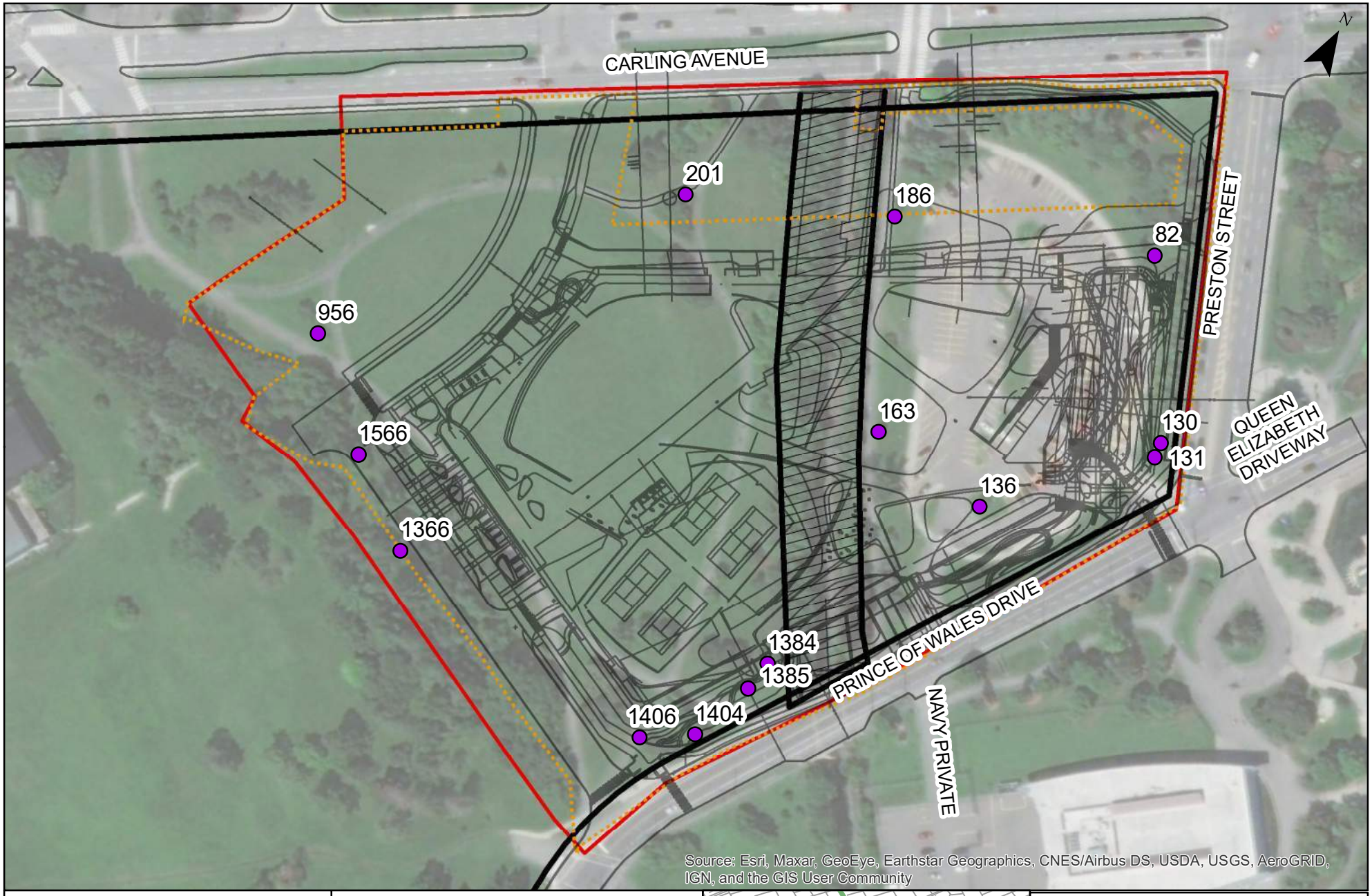


Figure 2J

Tree Inventory Overview
The Ottawa Hospital
Phase 2 Parking Garage
Environmental Effects Analysis

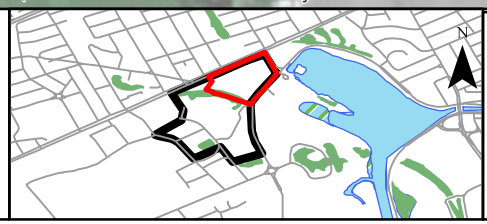


0 10 20 40 60 80 Meters

PARSONS

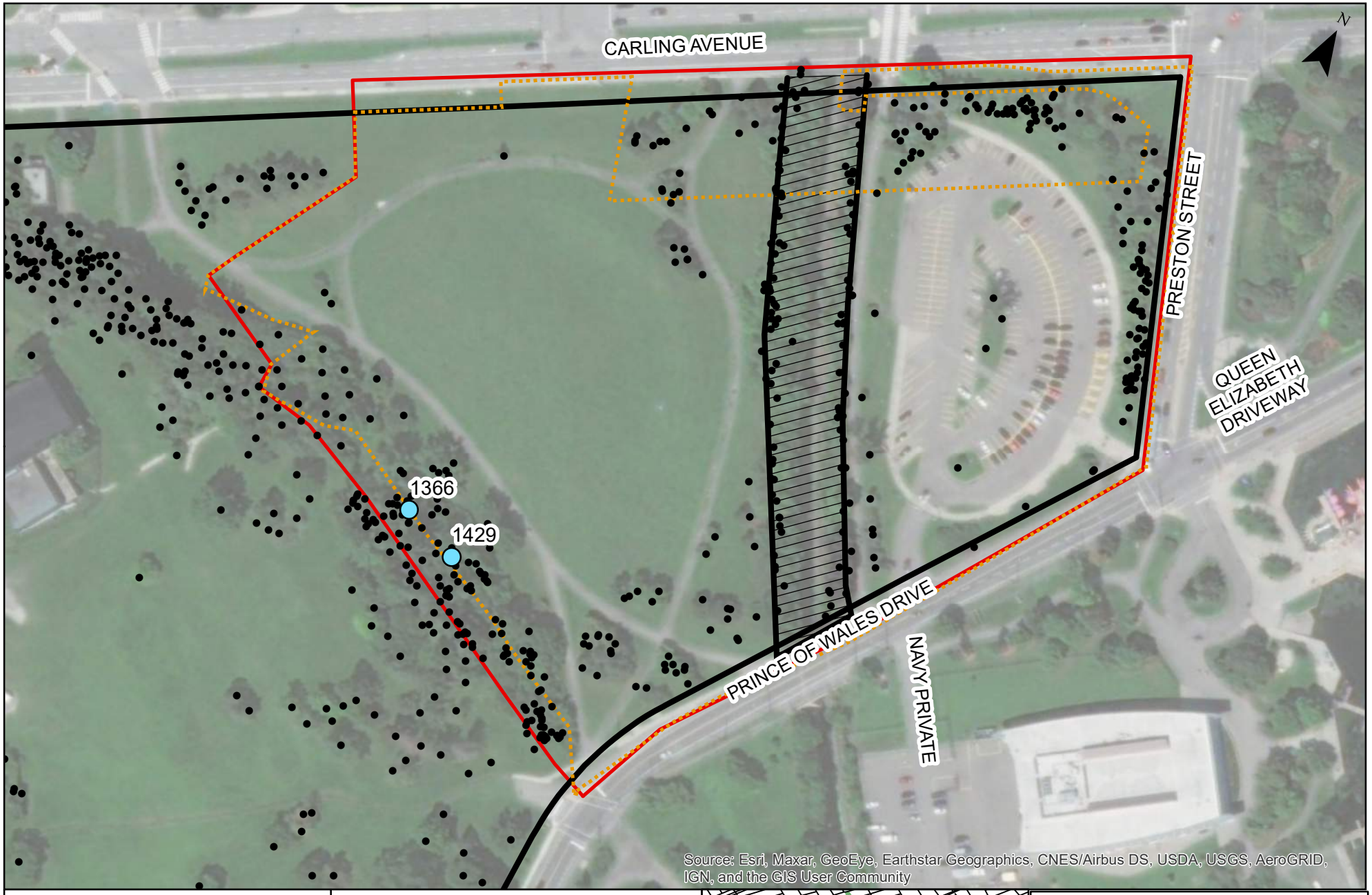
Legend

- Phase 2 Project Area
- Construction Limits
- Ottawa Hospital Lease Area
- LRT Corridor
- Candidates for Relocation



Candidates for Relocation

The Ottawa Hospital
Phase 2 Parking Garage
Environmental Effects Analysis



Meters
0 10 20 40 60 80

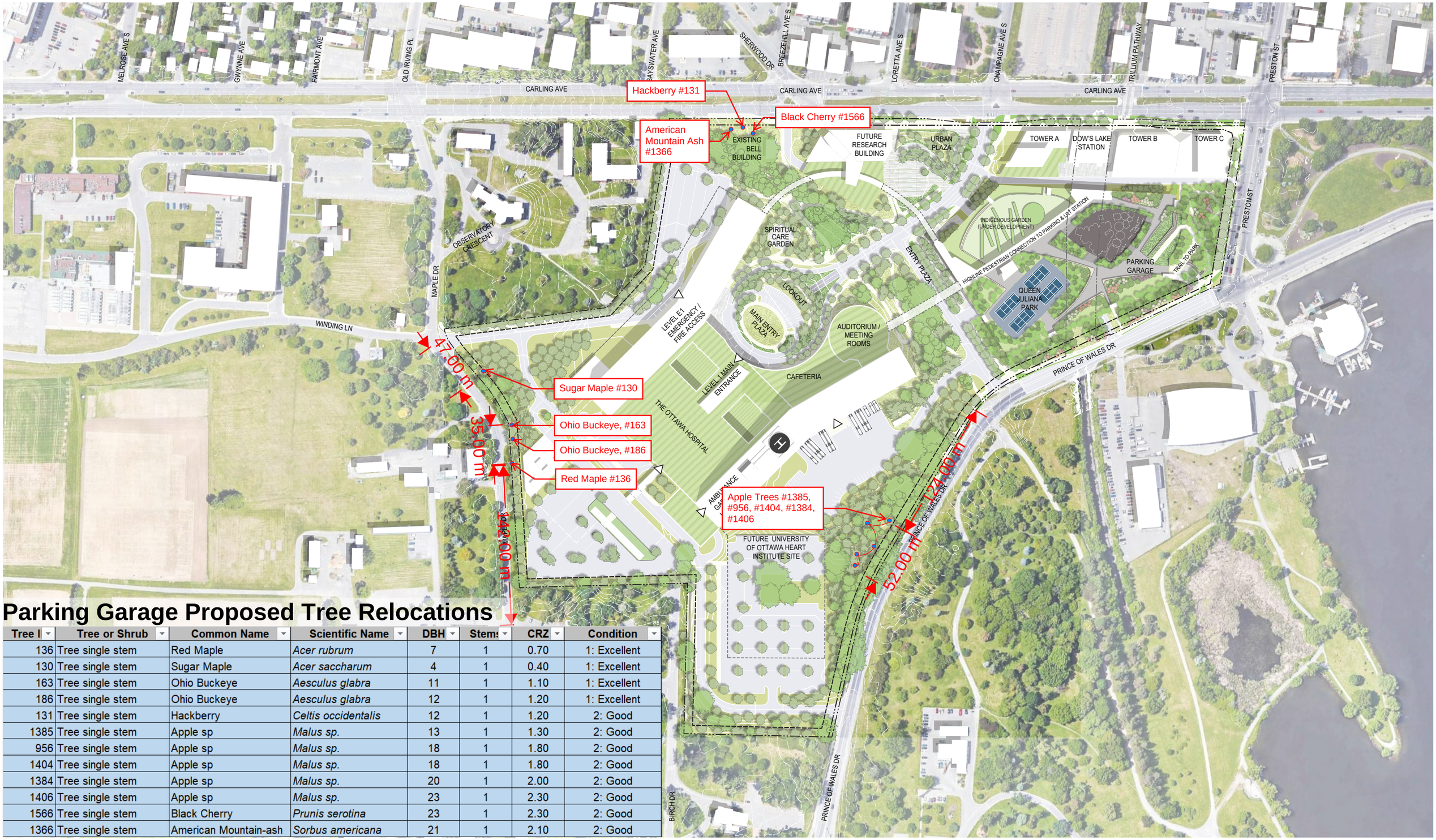
PARSONS

Legend

- Phase 2 Project Area
- Construction Limits
- Ottawa Hospital Lease Area
- LRT Corridor
- Potential Design-based Retentions
- Tree Locations

Figure 4

Potential Design-Based Retention
The Ottawa Hospital
Phase 2 Parking Garage
Environmental Effects Analysis



Parking Garage Proposed Tree Relocations

Tree I	Tree or Shrub	Common Name	Scientific Name	DBH	Stems	CRZ	Condition
136	Tree single stem	Red Maple	*Acer rubrum*	7	1	0.70	1: Excellent
130	Tree single stem	Sugar Maple	*Acer saccharum*	4	1	0.40	1: Excellent
163	Tree single stem	Ohio Buckeye	*Aesculus glabra*	11	1	1.10	1: Excellent
186	Tree single stem	Ohio Buckeye	*Aesculus glabra*	12	1	1.20	1: Excellent
131	Tree single stem	Hackberry	*Celtis occidentalis*	12	1	1.20	2: Good
1385	Tree single stem	Apple sp	*Malus sp.*	13	1	1.30	2: Good
956	Tree single stem	Apple sp	*Malus sp.*	18	1	1.80	2: Good
1404	Tree single stem	Apple sp	*Malus sp.*	18	1	1.80	2: Good
1384	Tree single stem	Apple sp	*Malus sp.*	20	1	2.00	2: Good
1406	Tree single stem	Apple sp	*Malus sp.*	23	1	2.30	2: Good
1566	Tree single stem	Black Cherry	*Prunis serotina*	23	1	2.30	2: Good
1366	Tree single stem	American Mountain-ash	*Sorbus americana*	21	1	2.10	2: Good

NEW CIVIC DEVELOPMENT FOR THE OTTAWA HOSPITAL

NEW CIVIC DEVELOPMENT FOR THE OTTAWA HOSPITAL
OPEN SPACE, LANDSCAPE, AND GRADING CONCEPT

February 1, 2022 DRAFT

0 75 150 300 Meters

True North

Appendix A: Phase 2 Parking Garage Tree Inventory Data, Updated February 23, 2022

New Civic Development for the Ottawa Hospital
Date Range of Fieldwork: March 8-23, 2021

GPS Unit: Bad Elf GNSS Surveyor
Accuracy: 1-3 m
Coordinate System: NAD 1984 - MTM 9

Note: This tree inventory was completed in support of the Phase 2 Parking Garage Site Plan EEA and EIS Report. All trees and shrubs were inventoried during leaf-off condition, therefore tree condition ratings are based on observed characteristics of branches and stem. Spatial accuracy may differ from advertised accuracy of GPS Unit due to factors including satellite availability and weather. Locations will be updated using high-accuracy methods as required to inform protection measures where required.

Tree ID	Tree or Shrub	Common Name	Scientific Name	DBH	Stems	CRZ	Condition	Notes	Phase 2 Action	Reason for Removal	Phase of Impacts	X	Y
1	Tree single stem	Scots Pine	*Pinus sylvestris*	26	1	2.6	4: Poor	70% dieback	Retain		Phase 7	-75.70780182	45.39709854
2	Tree single stem	Scots Pine	*Pinus sylvestris*	31	1	3.1	3: Fair	Low vigour, unbalanced canopy, 15% dieback	Retain		Phase 7	-75.707901	45.39709854
3	Tree single stem	Siberian Elm	*Ulmus pumila*	26	1	2.6	2: Good		Retain		LRT	-75.70929718	45.39670181
4	Tree single stem	Siberian Elm	*Ulmus pumila*	18	1	1.8	2: Good		Retain		LRT	-75.70929718	45.39670181
5	Tree single stem	Siberian Elm	*Ulmus pumila*	34	1	3.4	2: Good		Retain		LRT	-75.709198	45.39670181
6	Tree single stem	Hawthorn sp.	*Crataegus sp.*	29	1	2.9	2: Good		Retain		LRT	-75.709198	45.39659882
7	Tree single stem	Hawthorn sp.	*Crataegus sp.*	8	1	0.8	2: Good		Retain		LRT	-75.709198	45.39659882
8	Tree single stem	Siberian Elm	*Ulmus pumila*	24	1	0.0	5: Dead	No live growth observed, bark is falling off trunk	Retain		LRT	-75.709198	45.39659882
9	Tree multi stem	Unknown	*n/a*	15	5	1.5	2: Good		Retain		Phase 5	-75.70929718	45.39659882
10	Tree multi stem	Siberian Elm	*Ulmus pumila*	31	2	3.1	2: Good		Retain		Phase 5	-75.709198	45.39649963
11	Tree multi stem	Norway Maple	*Acer platanoides*	18	5	1.8	2: Good		Retain		Phase 5	-75.709198	45.39649963
12	Tree single stem	Carolina Poplar	*Populus carolina*	23	1	2.3	2: Good		Retain		Phase 5	-75.709198	45.39649963
13	Tree multi stem	Manitoba Maple	*Acer negundo*	27	5	2.7	2: Good		Retain		LRT	-75.70909882	45.39649963
14	Tree multi stem	Manitoba Maple	*Acer negundo*	22	8	2.2	2: Good		Retain		Phase 5	-75.70909882	45.39640045
15	Tree single stem	Scots Pine	*Pinus sylvestris*	18	1	1.8	2: Good		Retain		LRT	-75.709198	45.39649963
16	Tree single stem	Carolina Poplar	*Populus carolina*	18	1	1.8	2: Good		Retain		LRT	-75.70909882	45.39640045
17	Tree single stem	Carolina Poplar	*Populus carolina*	23	1	2.3	2: Good		Retain		LRT	-75.70909882	45.39640045
18	Tree single stem	Norway Maple	*Acer platanoides*	23	1	2.3	2: Good		Retain		Phase 5	-75.70909882	45.39630127
19	Tree single stem	Manitoba Maple	*Acer negundo*	17	1	1.7	2: Good		Retain		LRT	-75.70909882	45.39630127
20	Tree single stem	Manitoba Maple	*Acer negundo*	12	1	1.2	2: Good		Retain		Phase 5	-75.70909882	45.39630127
21	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	32	1	0.0	5: Dead	Bark falling off trunk	Retain		LRT	-75.70909882	45.39630127
22	Tree single stem	Manitoba Maple	*Acer negundo*	21	1	2.1	2: Good		Retain		LRT	-75.70909882	45.39630127
23	Tree single stem	Manitoba Maple	*Acer negundo*	18	1	1.8	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70899963	45.39630127
24	Tree single stem	Manitoba Maple	*Acer negundo*	15	1	1.5	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70899963	45.39630127
25	Tree multi stem	Manitoba Maple	*Acer negundo*	32	2	3.2	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70899963	45.39630127
26	Tree multi stem	Manitoba Maple	*Acer negundo*	23	3	2.3	3: Fair	Observed dieback	Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70899963	45.39619827
27	Tree single stem	Manitoba Maple	*Acer negundo*	25	1	2.5	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70890045	45.39619827
28	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	12	1	1.2	4: Poor	Bark falling off tree and observed dieback	Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70899963	45.39619827
29	Tree single stem	European Buckthorn	*Rhamnus cathartica*	11	1	0.0	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70899963	45.39619827
30	Tree multi stem	Green Ash	*Fraxinus pennsylvanica*	15	3	1.5	4: Poor	Bark falling off tree, significant decals. No new growth observ	Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70890045	45.39609909
31	Tree single stem	Manitoba Maple	*Acer negundo*	14	1	1.4	3: Fair	Growth into the fence causing abnormalities	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70890045	45.39599991
32	Tree single stem	Manitoba Maple	*Acer negundo*	41	1	4.1	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70890045	45.39609909
33	Tree single stem	Manitoba Maple	*Acer negundo*	32	1	3.2	3: Fair	Leaning, parallel with ground	Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70890045	45.39599991
34	Tree multi stem	Manitoba Maple	*Acer negundo*	55	2	5.5	4: Poor	Significant decay, rotten trunk	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70890045	45.39599991
35	Tree single stem	Siberian Elm	*Ulmus pumila*	25	1	2.5	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70890045	45.39599991
36	Tree single stem	Manitoba Maple	*Acer negundo*	25	1	2.5	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70890045	45.39599991
37	Tree single stem	Manitoba Maple	*Acer negundo*	18	1	1.8	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70880127	45.39599991
38	Tree single stem	Manitoba Maple	*Acer negundo*	32	1	3.2	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70880127	45.39599991
39	Tree single stem	Manitoba Maple	*Acer negundo*	26	1	2.6	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70880127	45.39599991
40	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	23	1	0.0	5: Dead	Limbs falling off, significant decay and bark falling off	Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70880127	45.39599991
41	Tree single stem	Manitoba Maple	*Acer negundo*	16	1	1.6	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70880127	45.39599991
42	Tree single stem	Manitoba Maple	*Acer negundo*	27	1	2.7	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70880127	45.39590073
43	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	22	1	2.2	3: Fair	Decay observed	Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70880127	45.39590073
44	Tree multi stem	Manitoba Maple	*Acer negundo*	32	5	0.0	5: Dead		Remove	Dead tree. Direct conflict wi	Phase 2 Removal	-75.70880127	45.39580154
45	Tree single stem	European Buckthorn	*Rhamnus cathartica*	10	1	0.0	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70870209	45.39580154
46	Tree multi stem	Green Ash	*Fraxinus pennsylvanica*	15	2	0.0	5: Dead	Limbs fallen off, significant decay	Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70870209	45.39580154
47	Tree single stem	Manitoba Maple	*Acer negundo*	56	1	5.6	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70870209	45.39580154
48	Tree multi stem	Manitoba Maple	*Acer negundo*	15	5	1.5	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70870209	45.39580154
49	Tree multi stem	European Buckthorn	*Rhamnus cathartica*	10	4	0.0	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70860291	45.39559937
50	Tree single stem	Manitoba Maple	*Acer negundo*	17	1	1.7	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70850372	45.39559937
51	Tree single stem	Manitoba Maple	*Acer negundo*	23	1	2.3	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70850372	45.39550018
52	Tree single stem	Siberian Elm	*Ulmus pumila*	27	1	2.7	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70850372	45.39550018
53	Tree single stem	European Buckthorn	*Rhamnus cathartica*	10	1	0.0	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70850372	45.39550018
54	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	34	1	3.4	4: Poor	Decay observed	Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70839691	45.39550018
55	Tree single stem	Manitoba Maple	*Acer negundo*	34	1	3.4	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70850372	45.39550018
56	Tree multi stem	Manitoba Maple	*Acer negundo*	36	2	3.6	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70839691	45.39550018
57	Tree single stem	European Buckthorn	*Rhamnus cathartica*	11	1	0.0	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70839691	45.395401
58	Tree single stem	Norway Maple	*Acer platanoides*	28	1	2.8	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70829773	45.395401
59	Tree single stem	Carolina Poplar	*Populus carolina*	34	1	3.4	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70829773	45.395401
60	Tree single stem	Carolina Poplar	*Populus carolina*	14	1	1.4	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70829773	45.395401
61	Tree multi stem	White Elm	*Ulmus americana*	22	2	2.2	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70829773	45.395401
62	Tree single stem	Manitoba Maple	*Acer negundo*	24	1	0.0	5: Dead		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70829773	45.39530182
63	Tree single stem	White Elm	*Ulmus americana*	27	1	2.7	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70819855	45.39519882
64	Tree single stem	White Elm	*Ulmus americana*	16	1	1.6	4: Poor	Bark lose and decay observed	Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70819855	45.39519882
65	Tree multi stem	European Buckthorn	*Rhamnus cathartica*	10	6	0.0	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70809937	45.39519882
66	Tree single stem	White Elm	*Ulmus americana*	54	1	5.4	2: Good		Remove - LRT	Conflict with LRT trench wic	LRT Phase 2	-75.70809937	45.39509964
69	Tree single stem	Scots Pine	*Pinus sylvestris*	31	1	3.1	3: Fair	Low vigour, unbalanced canopy 15% dieback	Retain		Phase 7	-75.707901	45.39709854
70	Tree single stem	Apple sp	*Malus sp.*	33	1	3.3	2: Good	minor dieback	Remove	Conflict with MUP	Phase 2 Removal	-75.70770264	45.39699936
71	Tree multi stem	Scots Pine	*Pinus sylvestris*	24	3	2.4	3: Fair	Included bark, 15% dieback, multistem, unbalanced crown	Remove	Conflict with MUP	Phase 2 Removal	-75.70760345	45.39699936
72	Tree single stem	Scots Pine	*Pinus sylvestris*	37	1	3.7	2: Good	15% dieback	Remove	Conflict with MUP	Phase 2 Removal	-75.70749664	45.39699936
73	Tree single stem	Scots Pine	*Pinus sylvestris*	40	1	4.0	3: Fair	Unbalanced, broken branches, 15% dieback	Remove	Conflict with MUP	Phase 2 Removal	-75.70760345	45.39699936
74	Tree multi stem	Scots Pine	*Pinus sylvestris*	16	3	1.6	3: Fair	Unb, multi	Remove	Conflict with MUP	Phase 2 Removal	-75.70749664	45.39690018
75	Tree single stem	Scots Pine	*Pinus sylvestris*	27	1	2.7	2: Good		Remove	Conflict with MUP	Phase 2 Removal	-75.70749664	45.39690018
76	Tree multi stem	Staghorn Sumac	*Rhus typhina*	5	20	0.0	5: Dead	surrounded by/mixed with Lonicera tatarica	Remove	Conflict with MUP	Phase 2 Removal	-75.70760345	45.39690018
77	Shrub Grouping	Tatarian Honeysuckle	*Lonicera tatarica*	7	100	0.7	2: Good		Remove	Invasive, brush clearing	Phase 2 Removal	-75.70770264	45.39690018
78	Tree single stem	Manitoba Maple	*Acer negundo*	41	1	4.1	3: Fair	Large scar on trunk, interior decay	Remove	Conflict with MUP	Phase 2 Removal	-75.70749664	45.39680099
79	Tree multi stem	Amur Maple	*Acer ginnala*	15	3	1.5	2: Good	lean	Remove	Conflict with MUP	Phase 2 Removal	-75.70749664	45.39670181
80	Tree single stem	Amur Maple	*Acer ginnala*	12	1	1.2	3: Fair	30% dieback, lean	Remove	Conflict with MUP	Phase 2 Removal	-75.70749664	45.39680099
81	Tree multi stem	Apple sp	*Malus sp.*	24	2	2.4	2: Good	lean	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70760345	45.39670181
82	Tree multi stem	Apple sp	*Malus sp.*	17	4	1.7	2: Good	minor dieback	Relocate	Direct conflict with parking g	Phase 2 Removal	-75.70760345	45.39680099
83	Shrub Grouping	Manitoba Maple	*Acer negundo*	5	10	0.5	2: Good	within Lonicera tatarica grouping	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70760345	45.39680099
84	Tree multi stem	Apple sp	*Malus sp.*	13	2	1.3	3: Fair	dieback	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70770264	45.39680099

85	Tree single stem	Apple sp	*Malus sp.*	10	1	1.0	4: Poor	>60 dieback	Remove	Conflict with staging/constru	Phase 2 Removal	-75.70770264	45.39690018
86	Tree multi stem	Amur Maple	*Acer ginnala*	22	4	2.2	2: Good	lean	Remove	Conflict with MUP	Phase 2 Removal	-75.70749664	45.39670181
87	Tree multi stem	Amur Maple	*Acer ginnala*	16	2	1.6	2: Good	lean	Remove	Conflict with MUP	Phase 2 Removal	-75.70749664	45.39670181
88	Tree multi stem	Amur Maple	*Acer ginnala*	14	3	1.4	2: Good	lean	Remove	Conflict with MUP	Phase 2 Removal	-75.70749664	45.39670181
89	Tree multi stem	Amur Maple	*Acer ginnala*	14	3	1.4	2: Good	lean, epicormic growth	Remove	Conflict with MUP	Phase 2 Removal	-75.70739746	45.39670181
90	Tree single stem	Amur Maple	*Acer ginnala*	10	1	1.0	2: Good	lean, epicormic growth	Remove	Conflict with MUP	Phase 2 Removal	-75.70749664	45.39670181
91	Tree multi stem	Amur Maple	*Acer ginnala*	18	3	1.8	3: Fair	Scar bark removed	Remove	Conflict with MUP	Phase 2 Removal	-75.70739746	45.39670181
92	Tree multi stem	Amur Maple	*Acer ginnala*	12	3	1.2	2: Good	lean	Remove	Conflict with MUP	Phase 2 Removal	-75.70739746	45.39670181
93	Tree multi stem	Amur Maple	*Acer ginnala*	14	3	1.4	2: Good	lean	Remove	Conflict with MUP	Phase 2 Removal	-75.70739746	45.39670181
94	Tree multi stem	Amur Maple	*Acer ginnala*	15	2	1.5	2: Good	lean	Remove	Conflict with MUP	Phase 2 Removal	-75.70739746	45.39670181
95	Tree multi stem	Amur Maple	*Acer ginnala*	14	2	1.4	3: Fair	crack, bark removed	Remove	Conflict with MUP	Phase 2 Removal	-75.70739746	45.39670181
96	Tree multi stem	Amur Maple	*Acer ginnala*	13	2	1.3	4: Poor	large crack, scar	Remove	Conflict with MUP	Phase 2 Removal	-75.70739746	45.39659882
97	Tree multi stem	Amur Maple	*Acer ginnala*	12	3	1.2	3: Fair	bark removed	Remove	Conflict with MUP	Phase 2 Removal	-75.70739746	45.39659882
98	Tree multi stem	Amur Maple	*Acer ginnala*	17	2	1.7	4: Poor	epicormic growth, bark removed, 30% dieback	Remove	Conflict with MUP	Phase 2 Removal	-75.70739746	45.39659882
99	Tree multi stem	Amur Maple	*Acer ginnala*	14	3	1.4	2: Good	lean	Remove	Conflict with MUP	Phase 2 Removal	-75.70739746	45.39659882
100	Tree single stem	Amur Maple	*Acer ginnala*	14	1	1.4	2: Good	lean	Remove	Conflict with MUP	Phase 2 Removal	-75.70739746	45.39659882
101	Tree single stem	Amur Maple	*Acer ginnala*	15	1	1.5	3: Fair	Cracks	Remove	Conflict with MUP	Phase 2 Removal	-75.70729828	45.39659882
102	Tree single stem	Amur Maple	*Acer ginnala*	12	1	1.2	4: Poor	80% dieback	Remove	Conflict with MUP	Phase 2 Removal	-75.70739746	45.39659882
103	Tree multi stem	Amur Maple	*Acer ginnala*	9	2	0.9	3: Fair	lean	Remove	Conflict with MUP	Phase 2 Removal	-75.70729828	45.39659882
104	Tree multi stem	Amur Maple	*Acer ginnala*	12	2	1.2	3: Fair	Scar, lean	Remove	Conflict with MUP	Phase 2 Removal	-75.70729828	45.39659882
105	Tree multi stem	Amur Maple	*Acer ginnala*	11	2	1.1	3: Fair	Crooked	Remove	Conflict with MUP	Phase 2 Removal	-75.70729828	45.39649963
106	Tree multi stem	Amur Maple	*Acer ginnala*	10	2	1.0	3: Fair	frost crack	Remove	Conflict with MUP	Phase 2 Removal	-75.70729828	45.39649963
107	Tree multi stem	Amur Maple	*Acer ginnala*	10	3	1.0	3: Fair	heavily pruned	Remove	Conflict with MUP	Phase 2 Removal	-75.70729828	45.39649963
108	Tree multi stem	Amur Maple	*Acer ginnala*	14	4	1.4	4: Poor	broken leader, lean	Remove	Conflict with MUP	Phase 2 Removal	-75.70729828	45.39649963
109	Tree multi stem	Amur Maple	*Acer ginnala*	10	2	1.0	3: Fair	lean	Remove	Conflict with MUP	Phase 2 Removal	-75.70729828	45.39649963
110	Tree multi stem	Amur Maple	*Acer ginnala*	10	2	1.0	3: Fair	lean	Remove	Conflict with MUP	Phase 2 Removal	-75.7071991	45.39649963
111	Tree multi stem	Amur Maple	*Acer ginnala*	10	3	1.0	3: Fair	broken branches, lean	Remove	Conflict with MUP	Phase 2 Removal	-75.7071991	45.39649963
112	Tree multi stem	Amur Maple	*Acer ginnala*	10	5	1.0	3: Fair	dieback	Remove	Conflict with MUP	Phase 2 Removal	-75.70729828	45.39640045
113	Tree multi stem	Amur Maple	*Acer ginnala*	10	5	1.0	3: Fair	lean	Remove	Conflict with MUP	Phase 2 Removal	-75.7071991	45.39640045
114	Tree multi stem	Amur Maple	*Acer ginnala*	7	3	0.7	3: Fair	Crooked	Remove	Conflict with MUP	Phase 2 Removal	-75.7071991	45.39649963
115	Tree multi stem	Amur Maple	*Acer ginnala*	16	2	1.6	2: Good	pruned	Remove	Conflict with MUP	Phase 2 Removal	-75.7071991	45.39640045
116	Tree multi stem	Amur Maple	*Acer ginnala*	13	3	1.3	2: Good	lean	Remove	Conflict with MUP	Phase 2 Removal	-75.70729828	45.39640045
117	Tree multi stem	Amur Maple	*Acer ginnala*	12	3	1.2	3: Fair	1 stem dead, lean	Remove	Conflict with MUP	Phase 2 Removal	-75.7071991	45.39640045
118	Tree multi stem	Amur Maple	*Acer ginnala*	11	3	1.1	3: Fair	Pru car	Remove	Conflict with MUP	Phase 2 Removal	-75.7071991	45.39640045
119	Tree single stem	Amur Maple	*Acer ginnala*	8	1	0.8	2: Good	lean	Remove	Conflict with MUP	Phase 2 Removal	-75.7071991	45.39640045
120	Tree multi stem	Amur Maple	*Acer ginnala*	11	3	1.1	3: Fair	dieback	Remove	Conflict with MUP	Phase 2 Removal	-75.7071991	45.39640045
121	Tree multi stem	Amur Maple	*Acer ginnala*	12	3	1.2	3: Fair	lean	Remove	Conflict with MUP	Phase 2 Removal	-75.7071991	45.39640045
122	Tree multi stem	Amur Maple	*Acer ginnala*	8	2	0.8	2: Good	lean	Remove	Conflict with MUP	Phase 2 Removal	-75.7071991	45.39630127
123	Tree multi stem	Amur Maple	*Acer ginnala*	17	2	1.7	2: Good	lean	Remove	Conflict with MUP	Phase 2 Removal	-75.7071991	45.39640045
124	Tree multi stem	Amur Maple	*Acer ginnala*	11	2	1.1	2: Good	lean, epicormic growth	Remove	Conflict with MUP	Phase 2 Removal	-75.7071991	45.39630127
125	Tree multi stem	Amur Maple	*Acer ginnala*	4	3	0.4	4: Poor	Cut	Remove	Conflict with MUP	Phase 2 Removal	-75.7071991	45.39630127
126	Tree single stem	Amur Maple	*Acer ginnala*	5	1	0.5	2: Good	lean	Remove	Conflict with MUP	Phase 2 Removal	-75.7071991	45.39630127
127	Tree multi stem	Amur Maple	*Acer ginnala*	8	3	0.8	2: Good	lean	Remove	Conflict with MUP	Phase 2 Removal	-75.7071991	45.39630127
128	Tree multi stem	Amur Maple	*Acer ginnala*	15	3	1.5	3: Fair	crack	Remove	Conflict with MUP	Phase 2 Removal	-75.7071991	45.39630127
129	Tree multi stem	Amur Maple	*Acer ginnala*	15	6	1.5	3: Fair	Sca	Remove	Conflict with MUP	Phase 2 Removal	-75.7071991	45.39630127
130	Tree single stem	Sugar Maple	*Acer saccharum*	4	1	0.4	1: Excellent		Relocate	Conflict with MUP	Phase 2 Removal	-75.7071991	45.39630127
131	Tree single stem	Hackberry	*Celtis occidentalis*	12	1	1.2	2: Good	very low scaffold branches	Relocate	Conflict with MUP	Phase 2 Removal	-75.7071991	45.39619827
132	Tree single stem	Amur Maple	*Acer ginnala*	38	1	3.8	2: Good		Remove	Conflict with MUP	Phase 2 Removal	-75.7071991	45.39599991
133	Shrub Grouping	Eastern Red-cedar	*Juniperus virginiana*	6	3	0.6	1: Excellent		Remove	Conflict with MUP	Phase 2 Removal	-75.7071991	45.39599991
134	Shrub Grouping	Eastern Red-cedar	*Juniperus virginiana*	5	11	0.5	2: Good	buried in snow banks, cannot observe	Remove	Conflict with MUP	Phase 2 Removal	-75.70739746	45.39580154
135	Shrub Grouping	Common Ninebark	*Physocarpus opulifolia*	5	10	0.5	2: Good	10 + plants with over 5 stems each	Remove	Conflict with MUP	Phase 2 Removal	-75.70749664	45.39559937
136	Tree single stem	Red Maple	*Acer rubrum*	7	1	0.7	1: Excellent		Relocate	Direct conflict with parking g	Phase 2 Removal	-75.70770264	45.39580154
137	Tree multi stem	Russian Olive	*Elaeagnus angustifolia*	18	4	1.8	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70780182	45.395401
138	Tree multi stem	Russian Olive	*Elaeagnus angustifolia*	16	2	1.6	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70780182	45.395401
139	Tree multi stem	Russian Olive	*Elaeagnus angustifolia*	35	1	3.5	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.707901	45.39550018
140	Tree multi stem	Russian Olive	*Elaeagnus angustifolia*	12	2	1.2	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.707901	45.39550018
141	Tree single stem	Russian Olive	*Elaeagnus angustifolia*	11	1	1.1	2: Good	Thorns present - reverted from 'inermis' cultivar	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70800018	45.39559937
142	Tree single stem	Carolina Poplar	*Populus carolina*	100	1	10.0	2: Good	multiple codominant leaders	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70809937	45.39569855
143	Tree single stem	Norway Maple	*Acer platanoides*	44	1	4.4	1: Excellent		Remove - LRT	Conflict with LRT trench wid	LRT Phase 2	-75.707901	45.39530182
144	Tree single stem	White Elm	*Ulmus americana*	12	1	1.2	2: Good		Remove - LRT	Conflict with LRT trench wid	LRT Phase 2	-75.707901	45.39519882
145	Tree multi stem	Green Ash	*Fraxinus pennsylvanica*	7	10	0.7	4: Poor	emerald ash borer	Remove - LRT	Conflict with LRT trench wid	LRT Phase 2	-75.707901	45.39519882
146	Shrub Grouping	Staghorn Sumac	*Rhus typhina*	5	22	0.5	2: Good		Remove - LRT	Conflict with LRT trench wid	LRT Phase 2	-75.707901	45.39530182
147	Shrub Grouping	Tatarian Honeysuckle	*Lonicera tatarica*	3	15	0.3	2: Good		Remove - LRT	Conflict with LRT trench wid	LRT Phase 2	-75.70800018	45.39530182
148	Tree single stem	Norway Maple	*Acer platanoides*	41	1	4.1	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.707901	45.395401
149	Tree single stem	White Elm	*Ulmus americana*	10	1	0.0	5: Dead		Remove - LRT	Conflict with LRT trench wid	LRT Phase 2	-75.70800018	45.395401
150	Tree single stem	Norway Maple	*Acer platanoides*	45	1	4.5	1: Excellent		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70800018	45.395401
151	Tree multi stem	Manitoba Maple	*Acer negundo*	10	3	1.0	3: Fair	Cut, regrown	Remove - LRT	Conflict with LRT trench wid	LRT Phase 2	-75.70800018	45.39550018
152	Tree multi stem	Manitoba Maple	*Acer negundo*	5	7	0.5	4: Poor	Cut, regrown epicormic growth	Remove - LRT	Conflict with LRT trench wid	LRT Phase 2	-75.70809937	45.39550018
153	Tree single stem	Sugar Maple	*Acer saccharum*	39	1	3.9	1: Excellent		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70809937	45.39550018
154	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	6	1	0.6	4: Poor	epicormic growth - no living trunk	Remove - LRT	Conflict with LRT trench wid	LRT Phase 2	-75.70819855	45.39559937
155	Tree single stem	Apple sp	*Malus sp.*	10	1	1.0	4: Poor	Mostly dead	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70819855	45.39559937
156	Tree multi stem	European Buckthorn	*Rhamnus cathartica*	4	2	0.0	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70819855	45.39569855
157	Shrub	Green Ash	*Fraxinus pennsylvanica*	2	2	0.2	4: Poor	Epicormic growth only, main trunk cut down	Remove - LRT	Conflict with LRT trench wid	LRT Phase 2	-75.70829773	45.39569855
158	Tree multi stem	Green Ash	*Fraxinus pennsylvanica*	5	2	0.5	4: Poor	trunk cut, only epicormic growth living	Remove - LRT	Conflict with LRT trench wid	LRT Phase 2	-75.70829773	45.39580154
159	Shrub Grouping	Tatarian Honeysuckle	*Lonicera tatarica*	3	6	0.3	2: Good		Remove - LRT	Conflict with LRT trench wid	LRT Phase 2	-75.70829773	45.39580154
160	Tree single stem	Norway Maple	*Acer platanoides*	19	1	1.9	3: Fair	growing in fence, included bark	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70829773	45.39580154
161	Shrub	European Buckthorn	*Rhamnus cathartica*	8	3	0.0	3: Fair	broken branches	Remove - LRT	Conflict with LRT trench wid	LRT Phase 2	-75.70829773	45.39580154
162	Tree single stem	White Elm	*Ulmus americana*	27	1	2.7	3: Fair	15% dieback, bark removed, lean	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70829773	45.39590073
163	Tree single stem	Ohio Buckeye	*Aesculus glabra*	11	1	1.1	1: Excellent		Relocate	Direct conflict with parking g	Phase 2 Removal	-75.70829773	45.39590073
164	Tree single stem	European Buckthorn	*Rhamnus cathartica*	11	1	0.0	2: Good		Remove - LRT	Conflict with LRT trench wid	LRT Phase 2	-75.70839691	45.39590073
165	Shrub Grouping	Tatarian Honeysuckle	*Lonicera tatarica*	8	20	0.8	3: Fair	Mixed ash, Lon tart, rha cath in corridor	Remove - LRT	Conflict with LRT trench wid	LRT Phase 2	-75.70850372	45.39599991
166	Tree single stem	Russian Olive	*Elaeagnus angustifolia*	12	1	1.2	3: Fair		Remove - LRT	Conflict with LRT trench wid	LRT Phase 2	-75.70850372	45.39599991
167	Tree single stem	Russian Olive	*Elaeagnus angustifolia*	12	1	1.2	3: Fair		Remove - LRT	Conflict with LRT trench wid	LRT Phase 2	-75.70850372	45.39609909
168	Tree single stem	Russian Olive	*Elaeagnus angustifolia*	12	1	1.2	3: Fair		Remove - LRT	Conflict with LRT trench wid	LRT Phase 2	-75.70850372	45.39609909
169	Shrub	Green Ash	*Fraxinus pennsylvanica*	5	1	0.5	4: Poor		Remove - LRT	Conflict with LRT trench wid	LRT Phase 2	-75.70850372	45.39609909
170	Shrub	Tatarian Honeysuckle	*Lonicera tatarica*	5	30	0.5	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70839691	45.39609909
171	Tree single stem	White Elm	*Ulmus americana*	12	1	1.2	1: Excellent		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70850372	45.39609909
172	Tree multi stem	European Buckthorn	*Rhamnus cathartica*	10	6	0.0	3: Fair		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70850372	45.39609909
173	Tree single stem	Black Walnut	*Juglans nigra*	15	1	1.5	3: Fair	Living buds in lentiful canker on upper stem	Remove - LRT	Conflict with LRT trench wid	LRT Phase 2	-75.70860291	45.39619827
174	Tree single stem	Manitoba Maple	*Acer negundo*	20	1	2.0	3: Fair	crooked, unbalanced canopy, epicormic growth	Remove - LRT	Conflict with LRT trench wid	LRT Phase 2	-75.70860291	45.39619827

175	Tree single stem	Manitoba Maple	*Acer negundo*	20	1	2.0	3: Fair		Remove - LRT	Conflict with LRT trench wi	LRT Phase 2	-75.70860291	45.39619827
176	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	12	1	1.2	4: Poor		Remove - LRT	Conflict with LRT trench wi	LRT Phase 2	-75.70860291	45.39619827
177	Tree single stem	Norway Maple	*Acer platanoides*	35	1	3.5	1: Excellent		Remove - LRT	Conflict with LRT trench wi	LRT Phase 2	-75.70870209	45.39630127
178	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	20	1	2.0	4: Poor	epicormic growth	Remove - LRT	Conflict with LRT trench wi	LRT Phase 2	-75.70870209	45.39630127
179	Tree multi stem	Green Ash	*Fraxinus pennsylvanica*	7	3	0.7	4: Poor	Tree cut regen only	Remove - LRT	Conflict with LRT trench wi	LRT Phase 2	-75.70870209	45.39640045
180	Tree single stem	White Elm	*Ulmus americana*	15	1	1.5	2: Good		Remove - LRT	Conflict with LRT trench wi	LRT Phase 2	-75.70880127	45.39640045
181	Shrub	Hawthorn sp.	*Crataegus sp.*	7	4	0.7	2: Good		Retain		LRT	-75.70880127	45.39649963
182	Tree single stem	Manitoba Maple	*Acer negundo*	6	1	0.6	4: Poor	trunk cut, regenerative growth	Retain		LRT	-75.70890045	45.39649963
183	Tree multi stem	Green Ash	*Fraxinus pennsylvanica*	4	5	0.4	4: Poor	Cut, regenerative growth only	Retain		LRT	-75.70880127	45.39649963
184	Tree single stem	Siberian Elm	*Ulmus pumila*	10	1	1.0	3: Fair	broken leader	Retain		LRT	-75.70880127	45.39649963
185	Tree single stem	European Spindletree	*Euonymus europaeus*	5	1	0.5	3: Fair	Side leader dominant	Retain		LRT	-75.70880127	45.39649963
186	Tree single stem	Ohio Buckeye	*Aesculus glabra*	12	1	1.2	1: Excellent		Relocate	Conflict with staging/constru	Phase 2 Removal	-75.70870209	45.39649963
187	Tree single stem	Siberian Elm	*Ulmus pumila*	25	1	2.5	2: Good		Retain		LRT	-75.70880127	45.39659882
188	Tree single stem	Norway Maple	*Acer platanoides*	46	1	4.6	2: Good		Retain		LRT	-75.70890045	45.39659882
189	Tree single stem	Norway Maple	*Acer platanoides*	43	1	4.3	2: Good		Remove - LRT	Conflict with MUP	LRT Phase 2	-75.70899963	45.39670181
190	Tree multi stem	Russian Olive	*Elaeagnus angustifolia*	10	2	1.0	3: Fair	lean, pruned	Remove - LRT	Conflict with MUP	LRT Phase 2	-75.70899963	45.39670181
191	Tree single stem	Russian Olive	*Elaeagnus angustifolia*	39	1	3.9	3: Fair	scar, large secondary stem removed	Remove	Conflict with MUP	Phase 2 Removal	-75.70899963	45.39680099
192	Tree multi stem	Norway Spruce	*Picea abies*	28	2	2.8	2: Good		Retain		Phase 7	-75.70980072	45.39619827
193	Tree single stem	Norway Spruce	*Picea abies*	32	1	3.2	2: Good		Retain		Phase 7	-75.70980072	45.39619827
194	Tree single stem	Scots Pine	*Pinus sylvestris*	29	1	2.9	2: Good		Retain		Phase 7	-75.70980072	45.39630127
195	Tree multi stem	Scots Pine	*Pinus sylvestris*	29	2	2.9	2: Good		Retain		Phase 7	-75.70970154	45.39630127
196	Tree single stem	Norway Spruce	*Picea abies*	31	1	3.1	2: Good	Minor needle drop/dieback on shaded branches	Retain		Phase 7	-75.70970154	45.39630127
197	Tree single stem	Norway Spruce	*Picea abies*	30	1	3.0	1: Excellent		Retain		Phase 7	-75.70960236	45.39630127
198	Tree single stem	Hackberry	*Celtis occidentalis*	34	1	3.4	1: Excellent		Retain		Phase 7	-75.70960236	45.39640045
199	Tree single stem	Hackberry	*Celtis occidentalis*	22	1	2.2	1: Excellent		Retain		Phase 7	-75.70950317	45.39640045
200	Tree single stem	Hackberry	*Celtis occidentalis*	31	1	3.1	1: Excellent		Retain		Phase 7	-75.70950317	45.39640045
201	Tree single stem	Apple sp	*Malus sp.*	19	1	1.9	2: Good	trunk scar	Relocate	Conflict with MUP widening	Phase 2 Removal	-75.70950317	45.39619827
202	Tree single stem	Apple sp	*Malus sp.*	23	1	2.3	2: Good	trunk scar	Retain		Phase 7	-75.70950317	45.39609909
203	Tree single stem	Apple sp	*Malus sp.*	17	1	1.7	2: Good	trunk scar	Retain		Phase 7	-75.70950317	45.39609909
204	Tree single stem	Apple sp	*Malus sp.*	24	1	2.4	2: Good	trunk scar	Retain		Phase 7	-75.70950317	45.39609909
205	Tree single stem	Apple sp	*Malus sp.*	26	1	2.6	2: Good	trunk scar, broken branches	Retain		Phase 7	-75.70950317	45.39619827
206	Tree single stem	Apple sp	*Malus sp.*	27	1	2.7	2: Good	pruned	Remove	Conflict with staging/constru	Phase 2 Removal	-75.70950317	45.39609909
207	Tree single stem	Pitch Pine	*Pinus rigida*	34	1	3.4	2: Good	codominant stems, volunteer Acer negundo (5cm) growing ac	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70939636	45.39599991
208	Tree single stem	Pitch Pine	*Pinus rigida*	32	1	3.2	1: Excellent		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70929718	45.39599991
209	Tree single stem	European Larch	*Larix deciduosa*	24	1	2.4	1: Excellent		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70929718	45.39599991
210	Tree single stem	Pitch Pine	*Pinus rigida*	30	1	3.0	1: Excellent		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70929718	45.39599991
211	Tree single stem	Pitch Pine	*Pinus rigida*	28	1	2.8	1: Excellent		Remove	Direct conflict with parking g	Phase 2 Removal	-75.709198	45.39599991
212	Tree single stem	Pitch Pine	*Pinus rigida*	32	1	3.2	2: Good	crooked	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70929718	45.39599991
213	Tree single stem	Pitch Pine	*Pinus rigida*	25	1	2.5	2: Good		Retain		Phase 7	-75.70939636	45.39649963
214	Tree single stem	Pitch Pine	*Pinus rigida*	35	1	3.5	1: Excellent		Retain		Phase 7	-75.70939636	45.39640045
215	Tree single stem	Pitch Pine	*Pinus rigida*	25	1	2.5	1: Excellent		Retain		Phase 5	-75.70929718	45.39659882
216	Tree single stem	Pitch Pine	*Pinus rigida*	26	1	2.6	2: Good		Retain		Phase 7	-75.70929718	45.39649963
217	Tree single stem	Pitch Pine	*Pinus rigida*	32	1	3.2	2: Good		Retain		Phase 5	-75.70929718	45.39659882
218	Tree single stem	Pitch Pine	*Pinus rigida*	29	1	2.9	2: Good		Retain		Phase 5	-75.709198	45.39649963
219	Tree single stem	Colorado Blue Spruce	*Picea pungens*	24	1	2.4	1: Excellent		Retain		Phase 7	-75.70880127	45.39680099
220	Tree single stem	Colorado Blue Spruce	*Picea pungens*	26	1	2.6	1: Excellent		Retain		Phase 7	-75.70870209	45.39680099
221	Tree single stem	Colorado Blue Spruce	*Picea pungens*	36	1	3.6	1: Excellent		Retain		Phase 7	-75.70870209	45.39680099
222	Tree single stem	Sugar Maple	*Acer saccharum*	57	1	5.7	2: Good	codominant stem	Remove	Conflict with MUP	Phase 2 Removal	-75.70870209	45.39690018
223	Tree multi stem	Colorado Blue Spruce	*Picea pungens*	25	2	2.5	3: Fair	Cod db30	Remove	Conflict with MUP	Phase 2 Removal	-75.70860291	45.39690018
224	Tree single stem	Colorado Blue Spruce	*Picea pungens*	36	1	3.6	2: Good	15% dieback	Retain		Phase 7	-75.70860291	45.39680099
225	Tree single stem	Colorado Blue Spruce	*Picea pungens*	35	1	3.5	2: Good	15% dieback	Retain		Phase 7	-75.70860291	45.39670181
226	Tree single stem	Colorado Blue Spruce	*Picea pungens*	32	1	3.2	1: Excellent		Retain		Phase 7	-75.70870209	45.39670181
227	Tree single stem	Colorado Blue Spruce	*Picea pungens*	33	1	3.3	3: Fair	4 codominant stems, included bark 15% dieback	Retain		Phase 7	-75.70870209	45.39670181
228	Tree single stem	Colorado Blue Spruce	*Picea pungens*	29	1	2.9	2: Good		Retain		Phase 7	-75.70870209	45.39670181
229	Tree multi stem	Manitoba Maple	*Acer negundo*	31	2	3.1	3: Fair	lean, hollow, pruned	Retain		Phase 7	-75.70870209	45.39670181
230	Tree single stem	Apple sp	*Malus sp.*	13	1	1.3	4: Poor	Main stem cut horizontally leader	Retain		Phase 7	-75.70860291	45.39670181
231	Tree multi stem	Japanese Lilac	*Syringa reticulata*	13	3	1.3	2: Good		Retain		Phase 7	-75.70860291	45.39659882
232	Shrub	Japanese Lilac	*Syringa reticulata*	4	5	0.4	2: Good	broken stem at base	Retain		Phase 7	-75.70860291	45.39659882
233	Shrub	Japanese Lilac	*Syringa reticulata*	6	7	0.6	2: Good		Retain		Phase 7	-75.70860291	45.39659882
234	Shrub	Japanese Lilac	*Syringa reticulata*	6	11	0.6	2: Good		Retain		Phase 7	-75.70860291	45.39670181
235	Shrub	Japanese Lilac	*Syringa reticulata*	7	11	0.7	2: Good		Retain		Phase 7	-75.70860291	45.39670181
236	Tree multi stem	Apple sp	*Malus sp.*	20	5	2.0	2: Good		Retain		Phase 7	-75.70860291	45.39670181
237	Shrub	Japanese Lilac	*Syringa reticulata*	7	11	0.7	2: Good		Retain		Phase 7	-75.70860291	45.39670181
238	Tree multi stem	Amur Maple	*Acer ginnala*	16	3	1.6	2: Good	lean, multi-stem	Retain		Phase 7	-75.70850372	45.39690018
239	Tree multi stem	Amur Maple	*Acer ginnala*	20	3	2.0	2: Good	lean, multi-stem	Retain		Phase 7	-75.70850372	45.39690018
240	Tree multi stem	Amur Maple	*Acer ginnala*	12	2	1.2	3: Fair	lean, multi-stem, crack, pruned	Retain		Phase 7	-75.70850372	45.39690018
241	Tree multi stem	Amur Maple	*Acer ginnala*	13	3	1.3	3: Fair	lean, multi-stem, crack, pruned	Retain		Phase 7	-75.70850372	45.39690018
242	Tree multi stem	Amur Maple	*Acer ginnala*	21	3	2.1	2: Good	lean, multi-stem, crack	Retain		Phase 7	-75.70850372	45.39690018
243	Tree single stem	Amur Maple	*Acer ginnala*	13	1	1.3	4: Poor	crack, bark removed, decay	Retain		Phase 7	-75.70839691	45.39690018
244	Tree multi stem	Amur Maple	*Acer ginnala*	9	2	0.9	2: Good	lean, multi-stem	Retain		Phase 7	-75.70839691	45.39690018
245	Tree multi stem	Amur Maple	*Acer ginnala*	16	5	1.6	3: Fair	Bro cr	Retain		Phase 7	-75.70839691	45.39690018
246	Tree multi stem	Amur Maple	*Acer ginnala*	16	2	1.6	2: Good	lean, multi-stem	Retain		Phase 7	-75.70839691	45.39690018
247	Shrub	Amur Maple	*Acer ginnala*	4	2	0.4	3: Fair	Pru le	Retain		Phase 7	-75.70829773	45.39690018
248	Tree multi stem	Amur Maple	*Acer ginnala*	4	12	0.4	3: Fair	Pru regen	Retain		Phase 7	-75.70829773	45.39690018
249	Tree single stem	Amur Maple	*Acer ginnala*	13	1	1.3	4: Poor	Bark removed on leader	Retain		Phase 7	-75.70829773	45.39690018
250	Tree multi stem	Amur Maple	*Acer ginnala*	9	6	0.9	3: Fair	Epicormic growth, lean, pruned	Retain		Phase 7	-75.70829773	45.39690018
251	Shrub	Amur Maple	*Acer ginnala*	4	1	0.4	2: Good	lean, multi-stem	Retain		Phase 7	-75.70829773	45.39690018
252	Tree multi stem	Amur Maple	*Acer ginnala*	16	2	1.6	2: Good	lean, multi-stem	Retain		Phase 7	-75.70829773	45.39699936
253	Tree multi stem	Amur Maple	*Acer ginnala*	13	2	1.3	2: Good	lean, multi-stem	Retain		Phase 7	-75.70829773	45.39690018
254	Tree single stem	Amur Maple	*Acer ginnala*	5	1	0.5	3: Fair	lean, multi-stem	Retain		Phase 7	-75.70829773	45.39699936
255	Tree multi stem	Amur Maple	*Acer ginnala*	11	2	1.1	2: Good	lean, multi-stem	Retain		Phase 7	-75.70829773	45.39699936
256	Tree multi stem	Amur Maple	*Acer ginnala*	18	4	1.8	3: Fair	Re 15db	Retain		Phase 7	-75.70829773	45.39699936
257	Tree multi stem	Amur Maple	*Acer ginnala*	11	4	1.1	2: Good		Retain		Phase 7	-75.70829773	45.39699936
258	Shrub	Amur Maple	*Acer ginnala*	7	1	0.7	2: Good		Retain		Phase 7	-75.70829773	45.39699936
259	Tree multi stem	Amur Maple	*Acer ginnala*	16	3	1.6	3: Fair	Bro inc	Retain		Phase 7	-75.70829773	45.39699936
260	Shrub	Amur Maple	*Acer ginnala*	3	2	0.3	3: Fair		Retain		Phase 7	-75.70819855	45.39699936
261	Tree single stem	Amur Maple	*Acer ginnala*	11	1	1.1	3: Fair	Re	Retain		Phase 7	-75.70819855	45.39690018
262	Tree single stem	Amur Maple	*Acer ginnala*	12	1	1.2	3: Fair	crack, broken branches, epicormic growth	Retain		Phase 7	-75.70819855	45.39690018
263	Tree multi stem	Amur Maple	*Acer ginnala*	16	4	1.6	3: Fair	significant lean, epicormic growth	Retain		Phase 7	-75.70819855	45.39690018
264	Tree multi stem	Amur Maple	*Acer ginnala*	16	3	1.6	3: Fair	Re	Retain		Phase 7	-75.70819855	45.39699936

265	Tree single stem	Amur Maple	*Acer ginnala*	15	1	1.5	3: Fair	Re	Retain		Phase 7	-75.70819855	45.39699936
266	Tree multi stem	Amur Maple	*Acer ginnala*	17	17	1.7	4: Poor	Re cr rot	Retain		Phase 7	-75.70819855	45.39699936
267	Tree multi stem	Amur Maple	*Acer ginnala*	17	3	1.7	3: Fair	epicormic growth, bark removed	Retain		Phase 7	-75.70819855	45.39699936
268	Tree multi stem	Amur Maple	*Acer ginnala*	16	2	1.6	3: Fair	Re	Retain		Phase 7	-75.70819855	45.39699936
269	Tree multi stem	Amur Maple	*Acer ginnala*	15	3	1.5	3: Fair	Re	Retain		Phase 7	-75.70809937	45.39699936
270	Tree multi stem	Amur Maple	*Acer ginnala*	13	2	1.3	4: Poor	crack, broken	Retain		Phase 7	-75.70809937	45.39699936
271	Tree single stem	Staghorn Sumac	*Rhus typhina*	14	1	1.4	4: Poor	Re 60 db	Retain		Phase 7	-75.70809937	45.39699936
272	Tree single stem	Scots Pine	*Pinus sylvestris*	55	1	5.5	2: Good		Retain		Phase 7	-75.70800018	45.39699936
273	Tree single stem	Scots Pine	*Pinus sylvestris*	34	1	3.4	2: Good		Remove	Conflict with MUP	Phase 2 Removal	-75.70819855	45.39709854
274	Tree single stem	Scots Pine	*Pinus sylvestris*	23	1	0.0	5: Dead	No needles	Remove	Conflict with MUP	Phase 2 Removal	-75.70819855	45.39699936
275	Tree multi stem	Scots Pine	*Pinus sylvestris*	24	2	2.4	3: Fair	Cod 30db	Retain		Phase 7	-75.70819855	45.39699936
276	Tree multi stem	Apple sp	*Malus sp.*	17	2	1.7	3: Fair	Re bro	Retain		Phase 7	-75.70800018	45.39690018
277	Tree multi stem	Carolina Poplar	*Populus carolina*	39	4	3.9	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.707901	45.39630127
278	Tree single stem	Hackberry	*Celtis occidentalis*	3	1	0.3	4: Poor	Bro lead scarred secondary young tree badly damaged	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70800018	45.39640045
279	Tree single stem	Red Maple	*Acer rubrum*	51	1	5.1	4: Poor	broken leader, unlikely to recover	Remove	Direct conflict with parking g	Phase 2 Removal	-75.707901	45.39619827
473	Tree multi stem	Eastern White-cedar	*Thuja occidentalis*	14	5	1.4	2: Good		Remove - LRT	Conflict with LRT trench wid	LRT Phase 2	-75.70860291	45.39569855
475	Tree multi stem	Manitoba Maple	*Acer negundo*	14	4	1.4	2: Good		Remove - LRT	Conflict with LRT trench wid	LRT Phase 2	-75.70870209	45.39590073
482	Tree single stem	Manitoba Maple	*Acer negundo*	17	1	1.7	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70890045	45.39609909
955	Tree single stem	Apple sp	*Malus sp.*	25	1	2.5	2: Good		Remove	Conflict with staging area. N	Phase 2 Removal	-75.71070099	45.39530182
956	Tree single stem	Apple sp	*Malus sp.*	18	1	1.8	2: Good		Relocate	Conflict with staging area. N	Phase 2 Removal	-75.71060181	45.39530182
957	Tree single stem	Hazel sp	*Corylus sp.*	15	1	1.5	3: Fair	Bark damage in crown	Remove	Conflict with staging area. N	Phase 2 Removal	-75.71029663	45.39599991
958	Tree single stem	White Spruce	*Picea glauca*	37	1	3.7	1: Excellent		Retain		Phase 6	-75.71099854	45.39559937
959	Tree single stem	White Spruce	*Picea glauca*	28	1	2.8	1: Excellent		Retain		Phase 6	-75.71099854	45.39559937
960	Tree single stem	White Spruce	*Picea glauca*	36	1	3.6	1: Excellent		Retain		Phase 6	-75.71099854	45.39559937
965	Tree single stem	Scots Pine	*Pinus sylvestris*	36	1	3.6	2: Good		Retain		Phase 6	-75.71109772	45.39559937
1022	Tree single stem	Eastern White Pine	*Pinus strobus*	29	1	2.9	4: Poor	Crooked, 30% dieback	Retain		Phase 6	-75.71080017	45.39490128
1023	Tree single stem	Scots Pine	*Pinus sylvestris*	45	1	4.5	2: Good	unbalanced canopy	Retain		Retain	-75.71080017	45.39500046
1024	Tree single stem	White Poplar	*Populus alba*	14	1	1.4	3: Fair	Lean over path	Retain		Retain	-75.71089935	45.39500046
1025	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	6	1	0.6	2: Good		Retain		Retain	-75.71099854	45.39500046
1216	Tree single stem	White Spruce	*Picea glauca*	55	1	5.5	2: Good		Retain		Retain	-75.71009827	45.3946991
1217	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	14	1	1.4	2: Good		Retain		Retain	-75.71009827	45.3946991
1218	Tree single stem	White Spruce	*Picea glauca*	70	1	7.0	2: Good		Retain		Retain	-75.71009827	45.3946991
1219	Tree single stem	White Spruce	*Picea glauca*	29	1	2.9	3: Fair	Significant dieback 40%	Retain		Retain	-75.70999908	45.3946991
1220	Tree single stem	Eastern White Pine	*Pinus strobus*	34	1	3.4	3: Fair	Dieback observed 30%	Retain		Retain	-75.70999908	45.3946991
1221	Tree single stem	White Spruce	*Picea glauca*	42	1	4.2	2: Good		Retain		Retain	-75.70999908	45.3946991
1222	Tree single stem	Eastern White Pine	*Pinus strobus*	34	1	3.4	3: Fair	Observed dieback 20%	Retain		Retain	-75.70999908	45.3946991
1223	Tree single stem	Eastern White Pine	*Pinus strobus*	34	1	3.4	2: Good		Retain		Retain	-75.7098999	45.39479828
1224	Tree single stem	Scots Pine	*Pinus sylvestris*	37	1	3.7	3: Fair	Observed dieback 20%	Retain		Retain	-75.7098999	45.3946991
1225	Tree single stem	European Buckthorn	*Rhamnus cathartica*	12	1	0.0	2: Good		Retain		Retain	-75.70999908	45.3946991
1226	Tree single stem	Eastern White Pine	*Pinus strobus*	69	1	6.9	3: Fair	Observed dieback 10%	Retain		Retain	-75.70999908	45.3946991
1227	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	12	1	1.2	2: Good		Retain		Retain	-75.7098999	45.3946991
1228	Tree single stem	Scots Pine	*Pinus sylvestris*	23	1	2.3	4: Poor	No new growth observed	Retain		Retain	-75.7098999	45.3946991
1229	Tree single stem	White Spruce	*Picea glauca*	24	1	2.4	4: Poor	No new growth observed	Retain		Retain	-75.70980072	45.3946991
1230	Tree single stem	Eastern White Pine	*Pinus strobus*	60	1	6.0	3: Fair		Retain		Retain	-75.70980072	45.3946991
1231	Tree single stem	Scots Pine	*Pinus sylvestris*	33	1	3.3	3: Fair	Observed dieback	Retain		Retain	-75.70980072	45.3946991
1232	Tree single stem	White Spruce	*Picea glauca*	42	1	4.2	3: Fair	Observed dieback 10%	Retain		Retain	-75.70980072	45.3946991
1233	Tree single stem	White Spruce	*Picea glauca*	30	1	3.0	3: Fair	Observed dieback 10%	Retain		Retain	-75.70970154	45.3946991
1234	Tree single stem	White Spruce	*Picea glauca*	57	1	5.7	2: Good		Retain		Retain	-75.70970154	45.39459991
1235	Tree single stem	Eastern White Pine	*Pinus strobus*	71	1	7.1	2: Good		Retain		Retain	-75.70960236	45.39459991
1236	Tree single stem	Broadleaf Linden	*Tilia platyphyllos*	61	1	6.1	3: Fair	Prune and broken	Retain		Retain	-75.70950317	45.39450073
1261	Tree single stem	White Spruce	*Picea glauca*	65	1	6.5	2: Good		Retain		Retain	-75.70929718	45.39440155
1262	Tree single stem	American Sycamore	*Platanus occidentalis*	55	1	5.5	3: Fair	Included bark, 30% dieback	Retain		Retain	-75.70939636	45.39450073
1263	Tree single stem	Norway Maple	*Acer platanoides*	48	1	4.8	3: Fair	Cod bro prun large diam branches leaders bro epi	Retain		Retain	-75.709198	45.39440155
1280	Tree multi stem	Manitoba Maple	*Acer negundo*	10	5	0.0	5: Dead		Remove	Dead tree within fall distanc	Phase 2 Removal	-75.70870209	45.39440155
1281	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	10	1	0.0	5: Dead		Remove	Dead tree within fall distanc	Phase 2 Removal	-75.70880127	45.39440155
1282	Tree multi stem	European Buckthorn	*Rhamnus cathartica*	10	3	0.0	3: Fair	Epicormic growth	Retain		Retain	-75.70880127	45.39440155
1283	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	12	1	0.0	5: Dead		Remove	Dead tree within fall distanc	Phase 2 Removal	-75.70870209	45.39440155
1284	Tree multi stem	Manitoba Maple	*Acer negundo*	27	5	2.7	3: Fair	lean, broken branches, epicormic growth	Retain		Retain	-75.70870209	45.39440155
1285	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	16	1	0.0	5: Dead		Retain		Retain	-75.70870209	45.39440155
1286	Tree multi stem	Green Ash	*Fraxinus pennsylvanica*	9	2	0.0	5: Dead		Remove	Dead tree within fall distanc	Phase 2 Removal	-75.70870209	45.39440155
1287	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	11	1	0.0	5: Dead		Remove	Dead tree within fall distanc	Phase 2 Removal	-75.70880127	45.39440155
1288	Tree multi stem	European Buckthorn	*Rhamnus cathartica*	21	2	0.0	3: Fair	epicormic growth	Retain		Retain	-75.70880127	45.39440155
1289	Tree single stem	Chokecherry	*Prunus virginiana*	10	1	1.0	3: Fair	Lea tght cluster on edge of woodlot vines	Retain		Retain	-75.70880127	45.39440155
1290	Tree single stem	Chokecherry	*Prunus virginiana*	8	1	0.8	3: Fair	Lea tght cluster on edge of woodlot vines	Retain		Retain	-75.70880127	45.39440155
1291	Tree single stem	Chokecherry	*Prunus virginiana*	9	1	0.9	3: Fair	Lea tght cluster on edge of woodlot vines	Retain		Retain	-75.70880127	45.39440155
1292	Tree single stem	Chokecherry	*Prunus virginiana*	10	1	1.0	3: Fair	Lea tght cluster on edge of woodlot vines	Retain		Retain	-75.70880127	45.39440155
1293	Tree single stem	Chokecherry	*Prunus virginiana*	10	1	1.0	3: Fair	Lea tght cluster on edge of woodlot vines	Retain		Retain	-75.70880127	45.39440155
1294	Tree single stem	Chokecherry	*Prunus virginiana*	10	1	1.0	3: Fair	Lea tght cluster on edge of woodlot vines	Retain		Retain	-75.70880127	45.39440155
1295	Tree single stem	Chokecherry	*Prunus virginiana*	12	1	1.2	3: Fair	Lea tght cluster on edge of woodlot vines	Retain		Retain	-75.70880127	45.39429855
1296	Tree single stem	Chokecherry	*Prunus virginiana*	14	1	1.4	3: Fair	Lea tght cluster on edge of woodlot vines	Retain		Retain	-75.70890045	45.39440155
1297	Tree single stem	Chokecherry	*Prunus virginiana*	7	1	0.7	3: Fair	Lea tght cluster on edge of woodlot vines	Retain		Retain	-75.70880127	45.39440155
1298	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	30	1	0.0	5: Dead		Remove	Dead tree within fall distanc	Phase 2 Removal	-75.70890045	45.39440155
1299	Tree multi stem	European Buckthorn	*Rhamnus cathartica*	8	3	0.0	3: Fair		Retain		Retain	-75.70880127	45.39440155
1300	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	18	1	0.0	5: Dead		Remove	Dead tree within fall distanc	Phase 2 Removal	-75.70890045	45.39440155
1301	Tree single stem	Manitoba Maple	*Acer negundo*	10	1	1.0	3: Fair	Lea epi cod	Retain		Retain	-75.70890045	45.39440155
1302	Tree multi stem	Green Ash	*Fraxinus pennsylvanica*	15	2	0.0	5: Dead		Retain		Retain	-75.70880127	45.39440155
1303	Tree multi stem	Green Ash	*Fraxinus pennsylvanica*	11	2	0.0	5: Dead		Remove	Dead tree within fall distanc	Phase 2 Removal	-75.70880127	45.39440155
1304	Tree multi stem	European Spindletree	*Euonymus europaeus*	11	3	1.1	2: Good		Retain		Retain	-75.70890045	45.39450073
1305	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	20	1	0.0	5: Dead		Remove	Dead tree within fall distanc	Phase 2 Removal	-75.70880127	45.39450073
1306	Tree single stem	Chokecherry	*Prunus virginiana*	10	1	1.0	2: Good		Retain		Retain	-75.70890045	45.39440155
1307	Tree single stem	Chokecherry	*Prunus virginiana*	9	1	0.9	2: Good		Retain		Retain	-75.70880127	45.39450073
1308	Tree single stem	Black Cherry	*Prunus serotina*	13	1	0.0	5: Dead		Remove	Dead tree within fall distanc	Phase 2 Removal	-75.70890045	45.39450073
1309	Tree single stem	Chokecherry	*Prunus virginiana*	12	1	1.2	4: Poor	leader broken, fallen	Remove	Poor condition tree within fa	Phase 2 Removal	-75.70890045	45.39450073
1310	Tree single stem	Chokecherry	*Prunus virginiana*	8	1	0.8	4: Poor	Fallen bro lead	Remove	Poor condition tree within fa	Phase 2 Removal	-75.70890045	45.39450073
1311	Tree single stem	White Elm	*Ulmus americana*	16	1	1.6	4: Poor	Main trunk cut stem is epi lea cra	Remove	Conflict with Road B	Phase 2 Removal	-75.70890045	45.39459991
1312	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	11	1	1.1	4: Poor	Emerald ash borer, main trunk cut	Retain		Retain	-75.70890045	45.39440155
1313	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	18	1	1.8	4: Poor	only epicormic growth living	Remove	Poor condition, dying tree, d	Phase 2 Removal	-75.70899963	45.39450073
1314	Tree single stem	European Buckthorn	*Rhamnus cathartica*	14	1	0.0	3: Fair	epicormic growth, codominant stems	Remove	Conflict with Road B	Phase 2 Removal	-75.70899963	45.39459991
1315	Tree single stem	Manitoba Maple	*Acer negundo*	44	1	4.4	2: Good		Remove	Conflict with Road B	Phase 2 Removal	-75.70899963	45.39459991
1316	Tree multi stem	Manitoba Maple	*Acer negundo*	31	8	3.1	3: Fair	Lea epi 30 db	Remove	Conflict with Road B	Phase 2 Removal	-75.70899963	45.39459991

1317	Tree multi stem	Manitoba Maple	*Acer negundo*	14	2	1.4	3: Fair	Lea epi 30 db	Remove	Conflict with Road B	Phase 2 Removal	-75.70899963	45.39459991
1318	Tree multi stem	Manitoba Maple	*Acer negundo*	23	10	2.3	3: Fair	Lea epi 30 db	Remove	Conflict with Road B	Phase 2 Removal	-75.70899963	45.39459991
1319	Tree single stem	White Elm	*Ulmus americana*	22	1	2.2	2: Good		Remove	Conflict with Road B	Phase 2 Removal	-75.70899963	45.39459991
1320	Tree multi stem	Manitoba Maple	*Acer negundo*	10	5	1.0	3: Fair	Lea epi 30 db	Remove	Conflict with Road B	Phase 2 Removal	-75.70909882	45.39459991
1321	Tree multi stem	European Spindletree	*Euonymus europaeus*	10	2	1.0	4: Poor	Tree fallen on top	Remove	Conflict with Road B	Phase 2 Removal	-75.70909882	45.3946991
1322	Tree single stem	Black Cherry	*Prunus serotina*	7	1	0.7	3: Fair	Crooked	Retain		Retain	-75.70909882	45.39459991
1323	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	24	1	0.0	5: Dead		Remove	Dead tree within fall distanc	Phase 2 Removal	-75.70909882	45.39459991
1324	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	22	1	0.0	5: Dead		Remove	Dead tree within fall distanc	Phase 2 Removal	-75.70909882	45.39459991
1325	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	22	1	0.0	5: Dead		Remove	Dead tree within fall distanc	Phase 2 Removal	-75.70909882	45.39459991
1326	Tree single stem	European Buckthorn	*Rhamnus cathartica*	11	1	0.0	3: Fair		Retain		Retain	-75.70909882	45.39459991
1327	Tree multi stem	Manitoba Maple	*Acer negundo*	31	2	3.1	3: Fair	Lea epi 30 db	Remove	Declining tree within fall dis	Phase 2 Removal	-75.709198	45.39459991
1328	Tree multi stem	European Spindletree	*Euonymus europaeus*	21	2	2.1	4: Poor	Lea epi 30 db	Retain		Phase 3	-75.709198	45.39459991
1329	Tree single stem	White Elm	*Ulmus americana*	24	1	2.4	4: Poor	60% dieback	Remove	Diseased tree within fall dis	Phase 2 Removal	-75.709198	45.39459991
1330	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	35	1	0.0	5: Dead		Remove	Dead tree within fall distanc	Phase 2 Removal	-75.709198	45.39459991
1331	Tree single stem	European Buckthorn	*Rhamnus cathartica*	13	1	0.0	3: Fair	epicormic growth	Retain		Retain	-75.709198	45.39450073
1332	Tree single stem	Norway Spruce	*Picea abies*	44	1	4.4	3: Fair	30% dieback	Retain		Retain	-75.70929718	45.39450073
1333	Tree single stem	Norway Spruce	*Picea abies*	44	1	4.4	3: Fair	unbalanced crown	Retain		Retain	-75.70929718	45.39450073
1334	Tree single stem	European Buckthorn	*Rhamnus cathartica*	11	1	0.0	3: Fair	epicormic growth, lean	Retain		Retain	-75.70929718	45.39450073
1335	Tree single stem	Norway Spruce	*Picea abies*	39	1	3.9	3: Fair	unbalanced crown	Retain		Retain	-75.70929718	45.39450073
1336	Tree single stem	Norway Spruce	*Picea abies*	36	1	3.6	3: Fair	30% dieback, unbalanced crown, woodpecker holes	Retain		Retain	-75.70939636	45.39450073
1337	Tree single stem	European Buckthorn	*Rhamnus cathartica*	12	1	0.0	3: Fair	epicormic growth	Retain		Retain	-75.70929718	45.39459991
1338	Tree single stem	European Buckthorn	*Rhamnus cathartica*	7	1	0.0	3: Fair	epicormic growth	Retain		Retain	-75.70929718	45.39459991
1339	Tree single stem	White Spruce	*Picea glauca*	38	1	3.8	2: Good		Retain		Retain	-75.70939636	45.39459991
1340	Tree single stem	European Buckthorn	*Rhamnus cathartica*	10	1	0.0	3: Fair	epicormic growth	Retain		Retain	-75.70939636	45.39459991
1341	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	30	1	0.0	5: Dead		Remove	Dead tree within fall distanc	Phase 2 Removal	-75.70929718	45.39459991
1342	Tree single stem	White Spruce	*Picea glauca*	36	1	3.6	2: Good	unbalanced canopy	Retain		Retain	-75.70939636	45.39459991
1343	Tree single stem	White Spruce	*Picea glauca*	42	1	4.2	2: Good		Retain		Retain	-75.70939636	45.39459991
1344	Tree single stem	White Spruce	*Picea glauca*	39	1	3.9	2: Good	unbalanced canopy	Retain		Retain	-75.70950317	45.39459991
1345	Tree single stem	White Spruce	*Picea glauca*	20	1	2.0	2: Good	unbalanced canopy	Retain		Retain	-75.70950317	45.39459991
1346	Tree single stem	White Spruce	*Picea glauca*	49	1	4.9	2: Good	unbalanced canopy, 15% dieback	Retain		Retain	-75.70950317	45.39450073
1349	Tree single stem	Kentucky Coffeetree	*Gymnocladus dioicus*	21	1	2.1	2: Good	growing immediately adjacent to red pine	Retain		Retain	-75.71009827	45.39479828
1350	Tree single stem	Manitoba Maple	*Acer negundo*	6	1	0.6	2: Good		Retain		Retain	-75.71009827	45.39479828
1351	Tree single stem	Manitoba Maple	*Acer negundo*	7	1	0.7	2: Good		Retain		Retain	-75.71009827	45.39479828
1352	Tree single stem	Norway Spruce	*Picea abies*	64	1	6.4	2: Good	unbalanced canopy	Retain		Retain	-75.70999908	45.39479828
1353	Tree single stem	Norway Spruce	*Picea abies*	24	1	2.4	3: Fair	60% dieback	Retain		Retain	-75.7098999	45.39479828
1354	Tree single stem	Norway Spruce	*Picea abies*	20	1	2.0	3: Fair	60% dieback	Retain		Retain	-75.7098999	45.39479828
1355	Tree single stem	Norway Spruce	*Picea abies*	35	1	3.5	3: Fair	30% dieback	Potential Injury	CRZ overlaps grading limits	Phase 2 Injury	-75.7098999	45.39479828
1356	Tree single stem	Red Pine	*Pinus resinosa*	29	1	2.9	3: Fair	50% dieback	Potential Injury	CRZ overlaps grading limits	Phase 2 Injury	-75.7098999	45.39479828
1357	Tree single stem	Eastern White Pine	*Pinus strobus*	42	1	4.2	2: Good		Remove	Conflict with Road B	Phase 2 Removal	-75.70999908	45.39490128
1358	Tree single stem	Eastern White Pine	*Pinus strobus*	67	1	6.7	2: Good		Remove	Conflict with Road B	Phase 2 Removal	-75.70999908	45.39490128
1359	Tree single stem	Eastern White Pine	*Pinus strobus*	35	1	3.5	3: Fair	lean, codominant stems	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70980072	45.39500046
1360	Tree single stem	Eastern White Pine	*Pinus strobus*	30	1	3.0	3: Fair	30% dieback, codominant stems	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70980072	45.39500046
1361	Tree single stem	Eastern White Pine	*Pinus strobus*	41	1	4.1	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70980072	45.39500046
1362	Tree single stem	Eastern White Pine	*Pinus strobus*	38	1	3.8	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70980072	45.39500046
1363	Tree single stem	Eastern White Pine	*Pinus strobus*	33	1	3.3	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70980072	45.39500046
1364	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	7	1	0.7	2: Good		Remove	Conflict with Road B	Phase 2 Removal	-75.7098999	45.39479828
1365	Tree multi stem	Manitoba Maple	*Acer negundo*	23	2	2.3	4: Poor	epicormic growth, broken branches, 30% dieback	Remove	Conflict with Road B	Phase 2 Removal	-75.7098999	45.39490128
1366	Tree single stem	American Mountain-ash	*Sorbus americana*	21	1	2.1	2: Good		Relocate	Conflict with grading for Ro	Phase 2 Removal	-75.70980072	45.39479828
1367	Tree single stem	Red Pine	*Pinus resinosa*	39	1	3.9	3: Fair	30% dieback	Remove	Conflict with Road B	Phase 2 Removal	-75.7098999	45.39490128
1368	Tree single stem	European Buckthorn	*Rhamnus cathartica*	15	1	0.0	3: Fair	broken branches, codominant stems, lean	Retain		Retain	-75.7098999	45.39479828
1369	Tree single stem	American Mountain-ash	*Sorbus americana*	12	1	1.2	2: Good		Retain		Retain	-75.7098999	45.39479828
1370	Tree single stem	Red Pine	*Pinus resinosa*	38	1	3.8	3: Fair	30% dieback, broken branches	Potential Injury	CRZ overlaps grading limits	Phase 2 Injury	-75.7098999	45.39479828
1371	Tree single stem	Red Pine	*Pinus resinosa*	40	1	4.0	3: Fair	30% dieback, broken branches	Potential Injury	CRZ overlaps grading limits	Phase 2 Injury	-75.70980072	45.39479828
1372	Tree multi stem	American Mountain-ash	*Sorbus americana*	7	2	0.7	2: Good	codominant stems	Potential Injury	CRZ overlaps grading limits	Phase 2 Injury	-75.70980072	45.39479828
1373	Tree multi stem	Manitoba Maple	*Acer negundo*	24	5	2.4	3: Fair	codominant stems, lean, 15% dieback	Remove	Conflict with Road B	Phase 2 Removal	-75.70970154	45.39479828
1374	Tree multi stem	Manitoba Maple	*Acer negundo*	18	4	1.8	3: Fair	codominant stems, lean, 15% dieback	Remove	Conflict with Road B	Phase 2 Removal	-75.70980072	45.39490128
1375	Tree single stem	Manitoba Maple	*Acer negundo*	11	1	1.1	3: Fair	codominant stems, lean, 15% dieback	Remove	Conflict with Road B	Phase 2 Removal	-75.70970154	45.39490128
1376	Tree multi stem	Green Ash	*Fraxinus pennsylvanica*	19	3	1.9	4: Poor	1 stem dead	Remove	Conflict with Road B	Phase 2 Removal	-75.70970154	45.39479828
1377	Shrub Grouping	Staghorn Sumac	*Rhus typhina*	7	7	0.7	3: Fair		Remove	Conflict with Road B	Phase 2 Removal	-75.70970154	45.39490128
1378	Tree single stem	Hackberry	*Celtis occidentalis*	33	1	3.3	1: Excellent		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70950317	45.39490128
1379	Tree single stem	Hackberry	*Celtis occidentalis*	36	1	3.6	1: Excellent		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70939636	45.39479828
1380	Tree single stem	Hazel sp	*Corylus sp.*	25	1	2.5	4: Poor	scars, broken branches, topped	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70850372	45.39519882
1381	Tree single stem	Hazel sp	*Corylus sp.*	13	1	1.3	4: Poor	scars, broken branches, topped	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70850372	45.39519882
1382	Tree single stem	Red Pine	*Pinus resinosa*	31	1	3.1	3: Fair	codominant stems, 15% dieback	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70839691	45.395401
1383	Tree single stem	Red Pine	*Pinus resinosa*	24	1	2.4	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70839691	45.39530182
1384	Tree single stem	Apple sp	*Malus sp.*	20	1	2.0	2: Good		Relocate	Direct conflict with parking g	Phase 2 Removal	-75.70819855	45.39509964
1385	Tree single stem	Apple sp	*Malus sp.*	13	1	1.3	2: Good		Relocate	Direct conflict with parking g	Phase 2 Removal	-75.70819855	45.39500046
1386	Shrub	Viburnum sp.	*Viburnum sp.*	3	5	0.3	4: Poor	Mostly dead	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70829773	45.39500046
1387	Shrub	European Buckthorn	*Rhamnus cathartica*	5	30	0.0	3: Fair	within grouping of Viburnums	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70819855	45.39500046
1388	Shrub	Viburnum sp.	*Viburnum sp.*	2	13	0.2	3: Fair	30% dieback	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70829773	45.39500046
1389	Tree single stem	Austrian Pine	*Pinus nigra*	45	1	4.5	2: Good	codominant stems	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70850372	45.39500046
1390	Tree single stem	Austrian Pine	*Pinus nigra*	30	1	3.0	3: Fair	3 codominant stems	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70829773	45.39509964
1391	Tree single stem	Austrian Pine	*Pinus nigra*	40	1	4.0	3: Fair	codominant stem, 15% dieback	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70829773	45.39509964
1392	Shrub	Viburnum sp	*Viburnum sp.*	2	25	0.2	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70860291	45.39500046
1393	Tree single stem	Red Oak	*Quercus rubra*	30	1	3.0	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70860291	45.39500046
1394	Tree single stem	Red Oak	*Quercus rubra*	27	1	2.7	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70870209	45.39500046
1395	Tree single stem	Hackberry	*Celtis occidentalis*	4	1	0.4	4: Poor	scar at root collar	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70880127	45.39490128
1396	Tree single stem	Red Oak	*Quercus rubra*	32	1	3.2	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70880127	45.39490128
1397	Tree multi stem	Amur Maple	*Acer ginnala*	18	5	1.8	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70850372	45.39479828
1398	Tree multi stem	Amur Maple	*Acer ginnala*	6	10	0.6	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70839691	45.39479828
1399	Tree multi stem	Amur Maple	*Acer ginnala*	10	4	1.0	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70850372	45.39479828
1400	Tree single stem	White Elm	*Ulmus americana*	13	1	1.3	3: Fair	Lean, unbalanced crown, growing in canopy of Acer ginnala	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70839691	45.39479828
1401	Tree multi stem	Amur Maple	*Acer ginnala*	5	5	0.5	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70839691	45.39479828
1402	Tree single stem	Manitoba Maple	*Acer negundo*	20	1	2.0	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70839691	45.39479828
1403	Shrub	Viburnum sp	*Viburnum sp.*	5	30	0.5	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70839691	45.39479828
1404	Tree single stem	Apple sp	*Malus sp.*	18	1	1.8	2: Good	broken branch	Relocate	Direct conflict with parking g	Phase 2 Removal	-75.70829773	45.39479828
1405	Tree single stem	Apple sp	*Malus sp.*	30	1	3.0	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70850372	45.3946991
1406	Tree single stem	Apple sp	*Malus sp.*	23	1	2.3	2: Good		Relocate	Direct conflict with parking g	Phase 2 Removal	-75.70850372	45.3946991
1407	Tree single stem	Scots Pine	*Pinus sylvestris*	49	1	4.9	3: Fair	codominant stems, included bark, crooked	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70870209	45.3946991
1408	Tree single stem	Scots Pine	*Pinus sylvestris*	36	1	3.6	3: Fair	codominant stems, included bark	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70870209	45.39479828

1409	Tree single stem	Scots Pine	*Pinus sylvestris*	35	1	3.5	3: Fair	codominant stems, included bark	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70870209	45.3946991
1410	Tree single stem	Scots Pine	*Pinus sylvestris*	30	1	3.0	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70870209	45.3946991
1411	Tree single stem	Scots Pine	*Pinus sylvestris*	43	1	4.3	3: Fair	Codominant stems, included bark, crooked	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70880127	45.39459991
1412	Tree single stem	Apple sp	*Malus sp.*	29	1	2.9	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70880127	45.3946991
1413	Tree single stem	Apple sp	*Malus sp.*	27	1	2.7	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70880127	45.3946991
1414	Tree single stem	Apple sp	*Malus sp.*	25	1	2.5	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70880127	45.39479828
1415	Tree single stem	Apple sp	*Malus sp.*	31	1	3.1	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70880127	45.3946991
1416	Tree single stem	Apple sp	*Malus sp.*	20	1	2.0	3: Fair	Bark removed on large branch	Remove	Direct conflict with parking g	Phase 2 Removal	-75.70880127	45.39479828
1417	Tree single stem	Apple sp	*Malus sp.*	29	1	2.9	2: Good		Remove	Direct conflict with parking g	Phase 2 Removal	-75.70870209	45.39479828
1418	Tree single stem	Manitoba Maple	*Acer negundo*	12	1	1.2	2: Good		Remove	Conflict with Road B	Phase 2 Removal	-75.70939636	45.3946991
1419	Tree single stem	White Elm	*Ulmus americana*	11	1	1.1	4: Poor	Vine suppression, lean, bark re	Remove	Conflict with Road B	Phase 2 Removal	-75.70939636	45.3946991
1420	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	10	1	0.0	5: Dead	Vines and honeysuckle around	Remove	Dead tree. Conflict with Roa	Phase 2 Removal	-75.70939636	45.3946991
1421	Tree single stem	Black Cherry	*Prunus serotina*	10	1	0.0	5: Dead		Remove	Dead tree. Conflict with Roa	Phase 2 Removal	-75.70939636	45.3946991
1422	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	23	1	0.0	5: Dead		Remove	Dead tree. Conflict with Roa	Phase 2 Removal	-75.70939636	45.3946991
1423	Tree single stem	European Buckthorn	*Rhamnus cathartica*	12	1	0.0	2: Good		Remove	Conflict with Road B	Phase 2 Removal	-75.70939636	45.3946991
1424	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	26	1	0.0	5: Dead		Remove	Dead tree. Conflict with Roa	Phase 2 Removal	-75.70950317	45.3946991
1425	Tree single stem	Basswood	*Tilia americana*	23	1	2.3	2: Good		Retain		Retain	-75.70950317	45.39459991
1426	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	20	1	0.0	5: Dead		Remove	Dead tree. Conflict with Roa	Phase 2 Removal	-75.70950317	45.3946991
1427	Tree multi stem	Alternate-leaved Dogwoo	*Cornus alternifolia*	11	2	1.1	3: Fair	included bark, codominant stem	Remove	CRZ overlaps grading limits	Phase 2 Injury	-75.70950317	45.3946991
1428	Tree multi stem	Green Ash	*Fraxinus pennsylvanica*	27	2	0.0	5: Dead		Remove	Dead tree. Conflict with Roa	Phase 2 Removal	-75.70950317	45.3946991
1429	Tree single stem	Apple sp	*Malus sp.*	25	1	2.5	2: Good		Remove	Conflict with Road B	Phase 2 Removal	-75.70960236	45.39479828
1430	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	26	1	0.0	5: Dead		Remove	Dead tree. Conflict with Roa	Phase 2 Removal	-75.70950317	45.39479828
1431	Tree single stem	White Elm	*Ulmus americana*	34	1	3.4	2: Good		Remove	Conflict with Road B	Phase 2 Removal	-75.70960236	45.39479828
1432	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	8	1	0.8	4: Poor	dying, epicormic growth only alive	Retain		Retain	-75.70960236	45.3946991
1433	Tree multi stem	Manitoba Maple	*Acer negundo*	24	5	2.4	3: Fair	lean, 15% dieback, codominant stems	Retain		Retain	-75.70960236	45.3946991
1434	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	25	1	0.0	5: Dead		Remove	Dead tree within fall distanc	Phase 2 Removal	-75.70950317	45.3946991
1435	Tree single stem	White Spruce	*Picea glauca*	22	1	2.2	2: Good		Retain		Retain	-75.70950317	45.39459991
1436	Tree single stem	White Spruce	*Picea glauca*	39	1	3.9	3: Fair	30% dieback	Retain		Retain	-75.70950317	45.3946991
1437	Tree single stem	White Spruce	*Picea glauca*	50	1	5.0	2: Good		Retain		Retain	-75.70960236	45.39459991
1438	Tree single stem	White Spruce	*Picea glauca*	29	1	2.9	2: Good		Retain		Retain	-75.70970154	45.39459991
1439	Tree single stem	Red Pine	*Pinus resinosa*	26	1	2.6	3: Fair	lean, 30% dieback	Retain		Retain	-75.70970154	45.3946991
1440	Tree single stem	White Spruce	*Picea glauca*	44	1	4.4	2: Good		Retain		Retain	-75.70950317	45.39459991
1441	Tree single stem	White Spruce	*Picea glauca*	37	1	3.7	2: Good		Retain		Retain	-75.70950317	45.39450073
1442	Tree multi stem	Black Cherry	*Prunus serotina*	13	2	1.3	4: Poor	lean, broken branches, fungal fruity body	Remove	Conflict with Road B	Phase 2 Removal	-75.70960236	45.39479828
1443	Tree single stem	Manitoba Maple	*Acer negundo*	24	1	2.4	2: Good		Remove	Conflict with Road B	Phase 2 Removal	-75.70950317	45.39479828
1444	Tree multi stem	Green Ash	*Fraxinus pennsylvanica*	13	3	0.0	5: Dead		Remove	Dead tree. Conflict with Roa	Phase 2 Removal	-75.70939636	45.39479828
1445	Tree single stem	American Mountain-ash	*Sorbus americana*	11	1	1.1	3: Fair	lean	Remove	Conflict with Road B	Phase 2 Removal	-75.70939636	45.39479828
1446	Tree single stem	Manitoba Maple	*Acer negundo*	15	1	1.5	2: Good	vines	Remove	Conflict with Road B	Phase 2 Removal	-75.70939636	45.39479828
1447	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	14	1	0.0	5: Dead		Remove	Dead tree. Conflict with Roa	Phase 2 Removal	-75.70939636	45.39479828
1559	Tree multi stem	Manitoba Maple	*Acer negundo*	25	8	2.5	3: Fair	shared location, growing out of base of poplar	Retain		Retain	-75.71099854	45.39500046
1560	Tree single stem	Red Oak	*Quercus rubra*	29	1	2.9	1: Excellent	adjacent to open space	Remove	Direct conflict with parking g	Phase 2 Removal	-75.71009827	45.39509964
1561	Tree single stem	Norway Maple	*Acer platanoides*	29	1	2.9	2: Good		Remove	Conflict with Road B	Phase 2 Removal	-75.71029663	45.39509964
1562	Shrub Grouping	Common Buckthorn	*Rhamnus cathartica*	8	20	0.0	3: Fair	mixed with euoeuro dense cluster	Retain		Retain	-75.71080017	45.39509964
1563	Tree multi stem	Manitoba Maple	*Acer negundo*	27	5	2.7	3: Fair	lean, included bar	Remove	Conflict with grading for roa	Phase 2 Removal	-75.71060181	45.39509964
1564	Shrub Grouping	Staghorn Sumac	*Rhus typhina*	5	30	0.5	2: Good	Large cluster at base of slope	Retain		Retain	-75.71099854	45.39509964
1565	Tree multi stem	Manitoba Maple	*Acer negundo*	23	4	2.3	3: Fair	lean, included bar	Remove	Conflict with Road B	Phase 2 Removal	-75.71040344	45.39500046
1566	Tree single stem	Black Cherry	*Prunus serotina*	23	1	2.3	2: Good	Canopy shade suppressed	Relocate	Conflict with Road B	Phase 2 Removal	-75.71019745	45.39500046
1567	Tree single stem	White Spruce	*Picea glauca*	67	1	6.7	2: Good	Minor broken branches	Remove	Conflict with Road B	Phase 2 Removal	-75.71040344	45.39509964
1568	Tree multi stem	Manitoba Maple	*Acer negundo*	17	5	1.7	3: Fair	lean, included bark	Retain		Retain	-75.71029663	45.39490128
1569	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	28	1	0.0	5: Dead	Dead	Remove	Dead tree within fall distanc	Phase 2 Removal	-75.71050262	45.39490128
1570	Tree single stem	Red Pine	*Pinus resinosa*	36	1	3.6	3: Fair	Crooked stem	Retain		Phase 4	-75.71060181	45.39490128
1571	Tree single stem	White Spruce	*Picea glauca*	36	1	3.6	3: Fair	30% dieback	Potential Injury	CRZ overlaps grading limits	Phase 2 Injury	-75.71050262	45.39490128
1572	Tree single stem	Red Pine	*Pinus resinosa*	37	1	3.7	3: Fair	poor canopy vigour	Retain		Retain	-75.71040344	45.39490128
1573	Tree single stem	White Poplar	*Populus alba*	80	1	8.0	2: Good	manitoba maple growing out of base	Retain		Retain	-75.71099854	45.39500046
1574	Shrub	Lilac species	*Syringa sp*	9	6	0.9	2: Good	2 inc	Retain		Retain	-75.71070099	45.39490128
1575	Tree single stem	Black Walnut	*Juglans nigra*	10	1	1.0	4: Poor	4 80%db	Retain		Retain	-75.71070099	45.39490128
1576	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	9	1	0.9	4: Poor	4 eab	Retain		Retain	-75.71080017	45.39500046
1577	Tree multi stem	Manitoba Maple	*Acer negundo*	29	3	2.9	3: Fair	3 lea	Remove	Conflict with Road B	Phase 2 Removal	-75.71040344	45.39509964
1578	Tree multi stem	Manitoba Maple	*Acer negundo*	27	3	2.7	3: Fair	lean, included bar	Remove	Conflict with grading for roa	Phase 2 Removal	-75.71050262	45.39509964
1579	Shrub Grouping	Common Buckthorn	*Rhamnus cathartica*	8	12	0.0	3: Fair	Cluster of euro euro and rha catch small diam	Remove	Invasive, brush clearing	Phase 2 Removal	-75.71060181	45.39509964
1580	Tree single stem	Red Pine	*Pinus resinosa*	29	1	2.9	3: Fair	broken branches	Remove	Conflict with grading for roa	Phase 2 Removal	-75.71070099	45.39500046
1581	Tree single stem	Green Ash	*Fraxinus pennsylvanica*	20	1	0.0	5: Dead	Ded	Remove	Dead tree in fall distance of	Phase 2 Removal	-75.71080017	45.39509964
1582	Tree multi stem	Manitoba Maple	*Acer negundo*	24	5	2.4	3: Fair	lean, included bar	Remove	Conflict with grading for roa	Phase 2 Removal	-75.71060181	45.39500046
1583	Shrub	Common Buckthorn	*Rhamnus cathartica*	8	3	0.0	3: Fair		Retain		Retain	-75.71060181	45.39490128
1584	Tree single stem	Red Pine	*Pinus resinosa*	36	1	3.6	4: Poor	4 60%db	Potential Injury	CRZ overlaps grading limits	Phase 2 Injury	-75.71070099	45.39490128
1585	Tree multi stem	Manitoba Maple	*Acer negundo*	29	3	2.9	3: Fair	lean, included bar	Remove	Conflict with Road B	Phase 2 Removal	-75.71040344	45.39500046
1586	Tree single stem	White Pine	*Pinus strobus*	56	1	5.6	2: Good	2 crooked stem	Remove	Conflict with Road B	Phase 2 Removal	-75.71029663	45.39500046
1587	Tree multi stem	Manitoba Maple	*Acer negundo*	28	3	2.8	3: Fair	lean, included bar	Retain		Phase 6	-75.71070099	45.39479828

APPENDIX B: PARKING GARAGE LIFE CYCLE ASSESSMENT

The Ottawa Hospital
Parking Garage Life Cycle Assessment
06 June 2022

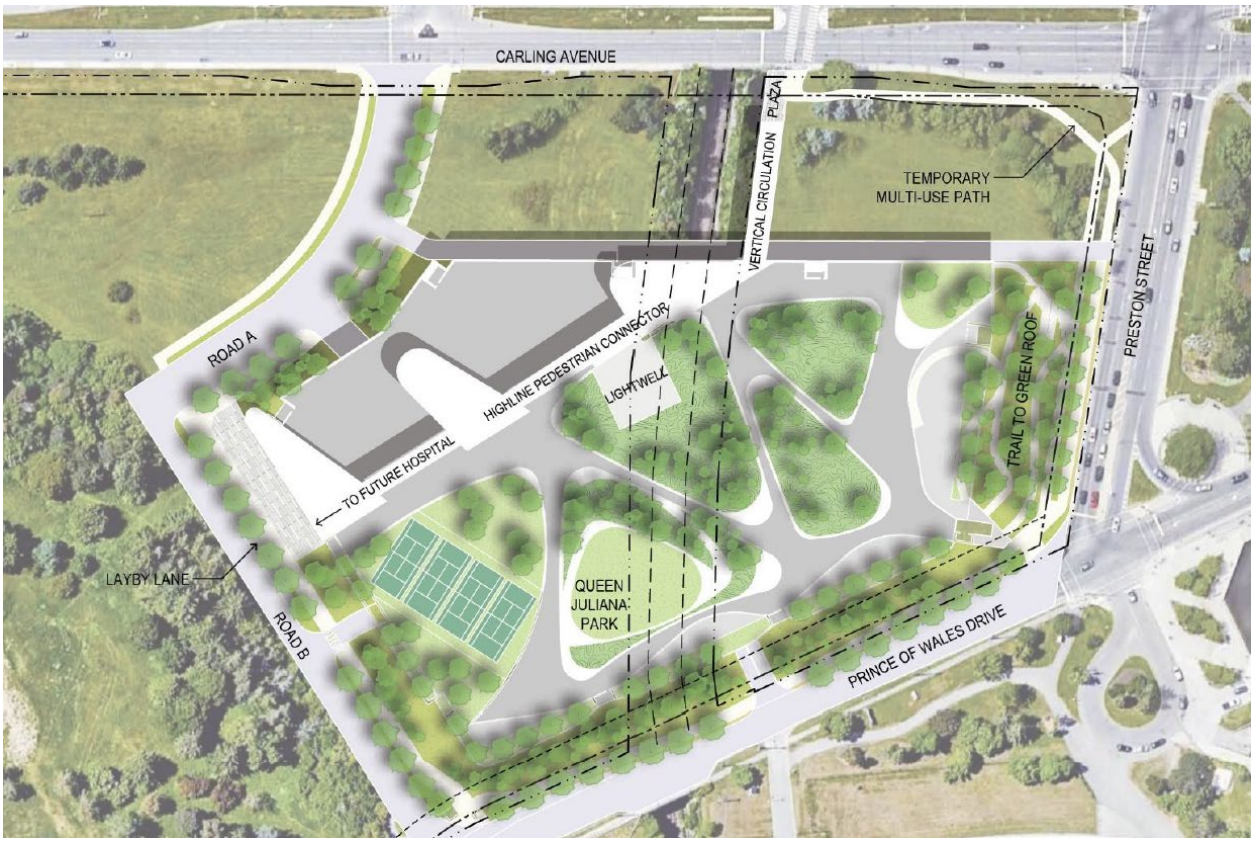
The Ottawa Hospital | L'Hôpital d'Ottawa

The Ottawa Hospital Parking Garage and Green Roof Carbon Intensity Analysis

Project Background

The Parking Garage and Green Roof provides necessary vehicle parking but also acts as a hub for active transportation and public open outdoor space. The structure connects the Hospital building, via a pedestrian bridge, with the Dow's Lake LRT station on the Trillium Line and indoor bicycle storage within the parking garage. The 5-acre park is proposed for the garage's roof and is a combination of a green roof and an active roof that will be available for use by the public and will be accessible from local streets.

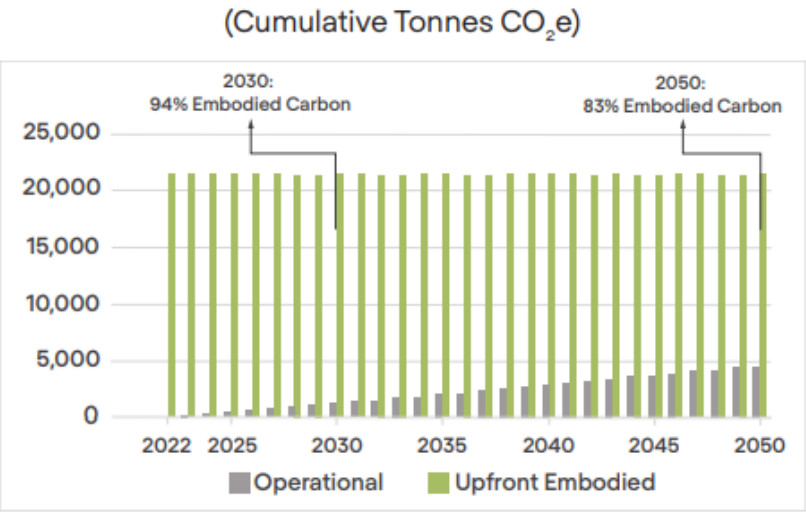
The Parking Garage is 5 levels (1 below grade, 4 above grade) with the active park level above the garage. The parking garage structure, foundation to the roof level, is cast in place and precast concrete. Structures above the roof, the "Highline pedestrian connector", will be mass timber. The garage contains 347 Secured Bicycle Parking Spaces and 2523 Personal Vehicle Parking Spaces including 25 electric vehicle charging stations.



Embodied Carbon

The Canada Green Building Council defines Embodied Carbon as "the carbon emissions associated with materials and construction processes throughout a building's life cycle." This is the carbon literally "embodied" in the constructed form and thus different from Operational Carbon, the carbon emitted through the operation of the building (eg the emission of carbon from the burning of natural gas to heat the building). In the past, the Operational Carbon has been the focus and led to energy use efficiency measures being seen as the primary way to reduce emissions.

As buildings have become more energy-efficient, a much larger portion of the total carbon emitted occurs through the construction process, sometimes the embodied CO_2 can even outweigh the cumulative operational CO_2 (refer to the opposite figure from the CaGBC) and therefore a focus of equal importance is now being placed on Embodied Carbon.



This is especially true for a structure such as this garage and green roof, which will have relatively low operating carbon emissions as the space is primarily unconditioned and thus the primary GHG emissions source will be from the initial construction and the eventual re-purposing of the building at end of service life. Given this condition, the greatest opportunity to reduce GHG emissions would be to reduce the embodied carbon of the structure to ensure optimization of the structure for lower embodied carbon intensity.

Carbon Intensity Analysis Methodology

This analysis is based on assessing an exported material take-off from the project's 3D Building Information Modeling (BIM) software Revit® to the widely industry-accepted Life Cycle Assessment (LCA) computer modeling tool Tally®. Tally quantifies Life Cycle Assessments (LCA) of building materials for whole-building analysis. Tally's methodology is consistent with LCA standards ISO 14040-14044, ISO 21930:2017, ISO 21931:2010, EN 15804:2012, and EN 15978:2011. Exporting the data directly from the BIM model to Tally ensured that the data is current with the state of the design and reflective of the drawing that will be used for tender.

Attached as appendices to this analysis are the output data from the two Tally model runs, the data output sheets also include additional information on the Tally software and methodology.

For this analysis, two Tally runs were completed. The first, a baseline represents the project as designed, using industry-standard materials. The baseline provides a picture of the project's Embodied Carbon Intensity (ECI) allowing comparison to industry benchmarks and suggests where the opportunities for carbon reduction may be found.

A second Embodied Carbon Intensity model, using the same design model, but with recommended lower embodied carbon materials, is then compared to the baseline to validate that the proposed low carbon strategies result in the reductions anticipated.

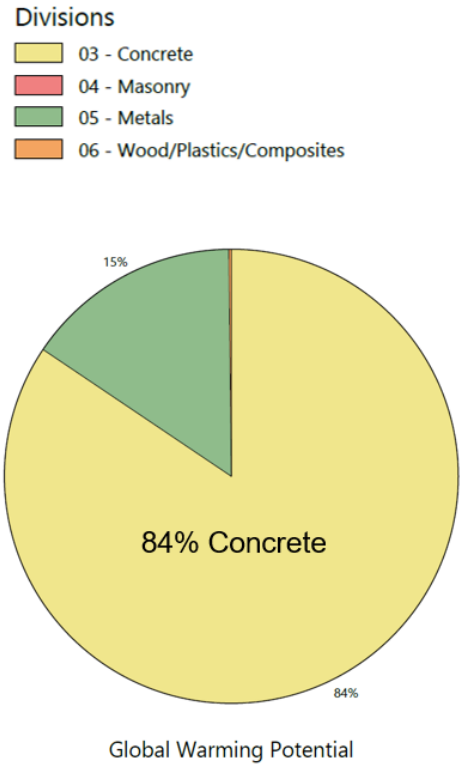
In this analysis specific attention was paid to the *Treasury Board's Greening Government Strategy: A Government of Canada Directive* which requires the reduction of "the embodied carbon of the structural materials by 30%" and ECCC's Quantification of net greenhouse gas (GHG) emissions. Structural materials are the focus of the LCA, in alignment with the Greening Government Strategy. It is important to note the ECCC's Quantification of net greenhouse gas (GHG) emissions can provide guidance on the topics of upstream GHG emissions, carbon sinks, and GHG mitigation measures, however, it is a standard that applies to operational industrial and other process emissions and is not completely relevant to real property.

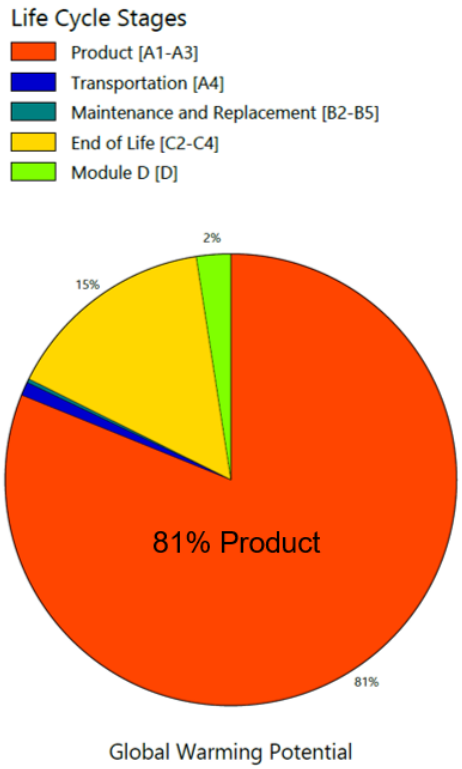
Also of note, the garage is currently in the design stage. This is the ideal time to review the Embodied Carbon Intensity and propose options to reduce that intensity. As there is time for these options to be specified in the tender construction documents. The analysis is based on industry-standard values, however, not product-specific Environmental Product Declarations (EPD). Once tenders are let the trades and suppliers will be required to provide product-specific EPD to maintain compliance with the ECI reduction targets.

Baseline Embodied Carbon Intensity

The base case run of the Tally model utilizing a typical cast in place and precast concrete structure (with GU Portland Cement and reinforcing steel); Structural Steel Tubing; and Mass Timber structure for the "Highline" yielded a total Life Cycle Embodied Carbon Intensity (ECI) of **823.1kg CO_2eq/m2;** and a Product [A1-A3] of **699.4 kg CO_2eq/m2**

The baseline Tally model highlighted the bulk of the ECI was related to the Concrete (84%) and during the Product [A1-A3] Life Cycle Stage (81%). Therefore the strategies for reductions were focused on Concrete during the Product [A1-A3] Life Cycle Stage.





Primary Embodied Carbon Reduction Strategies

There are a number of options to limit the embodied carbon emissions from the structure including using a mass timber structure where possible (e.g. above the green roof levels supporting the park functions). The primary concrete structure, however, remains the driver of the carbon emissions for this type of structure, and although it's not possible due to fire and durability issues to replace concrete with an alternative structural system there are a number of carbon reduction strategies that can be taken with a concrete structure.

According to the National Ready Mixed Concrete Association, 88% of average concrete mix CO_2 emissions are associated with the heating and calcination of limestone to produce the clinker that is crushed to produce Portland Cement. Therefore the replacement of the clinker in the cement mix with Supplementary Cementitious Materials (SCMs) can significantly reduce the carbon intensity of the concrete through the production stage.

Upon review of technical data on concrete performance and industry best practices, replacing clinker with 20% fly ash, from coal-burning power plants, and 30% slag, a byproduct from the steel blast furnaces, was recommended as SCM to replace some of the clinker. Re-running the Tally model with these SMCs **reduced the ECI of the entire structure by 25.3%** to a Stage A1 – A3 carbon intensity of **522.6 kg CO_2eq/m2**.

An additional 10% reduction is expected by replacing the Portland Cement with Portland Limestone Cement, however, this could not be modeled at this stage due to limitations in the Tally software's database but could be incorporated into a final model using product-specific EPD.

Note as the project is only in the design stage the computer modeling is based only on regional average values for ECI and would need to be re-evaluated once the specific supplier is selected as the location of the supplier's batching plants, precast manufacture location, the carbon intensity of the local electrical grid and proprietary cement mixes would all have impacts on the embodied carbon numbers. As the regional average values are by nature conservative and the industry is making significant strides to reduce CO_2 emissions, all expectations are that final values will improve over the design stage model.

Additional Embodied Carbon Reduction Strategies

Although not including the computer modeling software database other important strategies are being employed to reduce the ECI of the project even further than the modeled numbers. These include the following:

Build Less

The first strategy should always be to right-size the structure. The parking strategy for The Ottawa Hospital's New Campus Development went through an extensive transportation demand management exercise to ensure that the private vehicle parking space requirements were minimized. As a result of this exercise, the number of parking spaces was reduced by 40% thus reducing the building size and therefore the result ECI by a similar amount over a "business as usual" parking structure. This reduction in parking spaces was made possible by providing easy and convenient access to public transit and covering secured bike parking and thus reducing private vehicle parking demand. Beyond simply reducing the number of parking spaces the structure has been designed with a repetitive structural grid for the most efficient structural system possible thus reducing material use and in this way carbon intensity.

Scope 3 Emissions

Scope 3 Emissions are indirect emissions – not related to the functional use of the structure. In this case, scope 3 emissions would come from internal combustion private vehicle transportation to and from the parking garage. To

address these emissions several steps have been taken to reduce the carbon emissions that are associated with vehicle use. First, by providing convenient and accessible alternative transportation options such as walking, cycling, and rapid transit station, private vehicle use will be reduced. Second, the emissions impact of the vehicles themselves has also been considered through the provision of 25 electrical vehicle charging stations and priority parking given to carpooling, and through these measures reduce emissions associated with private automobile use.

End of Useful Life

Opportunities to reduce embodied carbon do not stop at the design and construction of the structure. Extending the structure's useful life, allowing for adaptive re-use, and ultimately planning for low-carbon material reuse/ recycling at end of life all reduced the structure's emissions intensity. For this structure, alternative uses have been considered by using a floor-to-floor height and a regular column grid will allow for low carbon repurposing of the building for office or other use. If, or when, other forms of application-based transportation or autonomous vehicles make the parking function redundant. In the eventuality of the complete demolition of the structure, the precast elements can be disassembled and reused for another structure and the pour-in-place concrete structure can be crushed and reused as aggregate in future construction projects in this way contributing to a circular economy approach and avoid emissions.

Carbon Sinks

The mass timber structure above the parking structure has been accounted for in the computer model. Other carbon sinks, including the additional tree and plant planting associated with at grade and rooftop landscaping, however, are not accounted for in the computer modeling. For the proposes of consistency with the Greening Government Strategy, which is focused on building structure, and for a conservative model of the reductions. Nevertheless, the planting will have a positive impact, as the average tree will sequester 10 kg/CO_2/ yr, therefore the additional planting will have a real significant positive climate impact that will only improve the actual reductions in Net CO_2.

Modeling Results

Base case Embodied Carbon Intensity (ECI)

699.4 kg CO_2eq/m2 Stage A1 – A3 Embodied Carbon

Results from the Tally computer model of the base case condition consisting of utilizing a typical cast in place and precast concrete structure (with GU Portland Cement and reinforcing steel); Structural Steel Tubing; and Mass Timber structure for the "Highline."

Reduced Embodied Carbon Intensity (ECI)

538 kg CO_2eq/m2 Stage A1 – A3 Embodied Carbon

Based on the computer modeling, and consultation with local suppliers, the specification of a 30% reduction in embodied carbon in the structure, as per the Greening Government Strategy, is feasible, in fact, it is expected a 40% reduction is possible once the product-specific EPD are utilized in the computer model, using the following modifications to a typical concrete specification:

- replace GU Portland Cement with 20% fly ash and 30% slag ash
- replace remaining GU Portland Cement with GUL Portland Limestone Cement
- utilize Carboncure or other CO_2 sequestering technology to inject CO_2 into the cement mix to permanently sequester carbon into the concrete.

Project Name

TOH parking - Tally Report

5/9/2022

Table of Contents

Report Summary

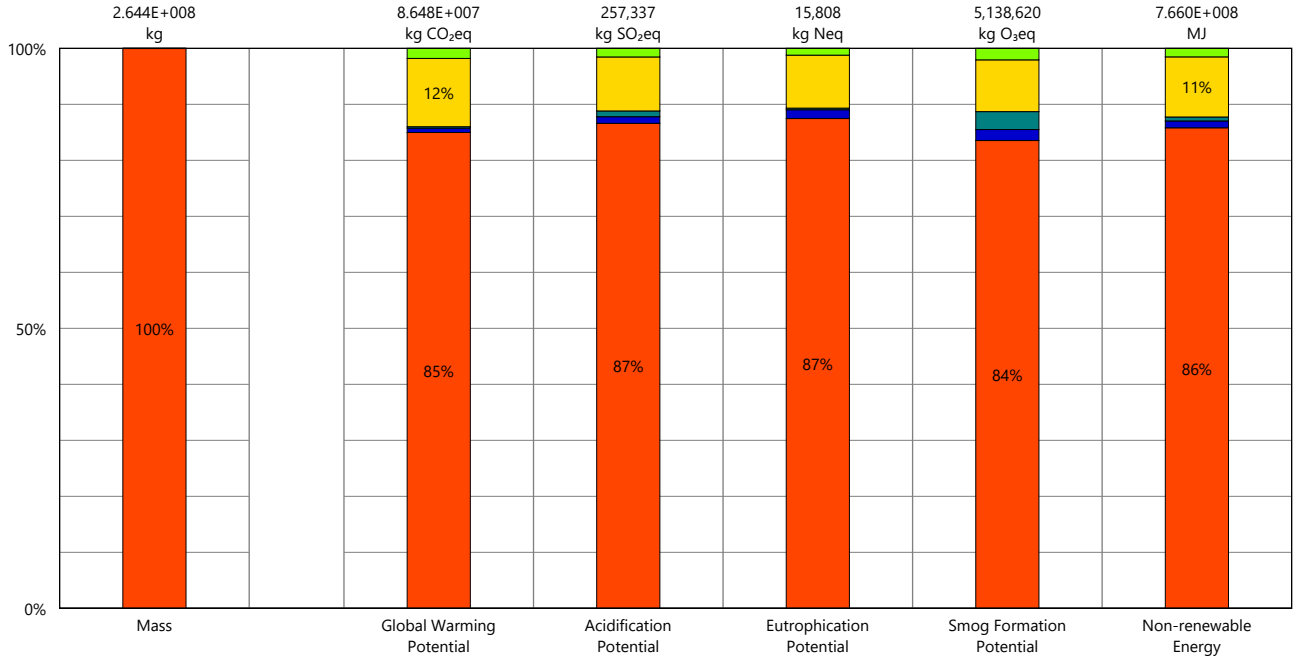
Created with Tally
Commercial Version 2022.04.08.01

Author	Nehal A.
Company	HDR
Date	5/9/2022
Project	Project Name
Location	1053 Carling Avenue Ottawa, ON, K1Y 4E9
Gross Area	105063 m^2
Building Life	60 years
Boundaries	Cradle to grave, inclusive of biogenic carbon; see appendix for a full list of materials and processes

Goal and Scope of Assessment
The goal of this assessment is to establish a baseline for the EC in the parking structure.

Environmental Impact Totals	**Product Stage [A1-A3]**	**Construction Stage [A4]**	**Use Stage [B2-B5]**	**End of Life Stage [C2-C4]**	**Module D [D]**
Global Warming (kg CO_2eq)	7.349E+007	658,938	231,567	1.054E+007	1,560,138
Acidification (kg SO_2eq)	222,862	3,053	2,647	24,810	3,965
Eutrophication (kg Neq)	13,826	248.6	45.84	1,495	192.8
Smog Formation (kg O_3eq)	4,292,614	100,892	164,359	474,862	105,893
Ozone Depletion (kg CFC-11eq)	0.2815	2.257E-008	7.216E-008	9.446E-007	-0.008704
Primary Energy (MJ)	7.043E+008	9,582,358	5,666,105	8.791E+007	9,233,864
Non-renewable Energy (MJ)	6.573E+008	9,353,057	5,441,315	8.220E+007	1.169E+007
Renewable Energy (MJ)	4.713E+007	231,714	227,252	5,807,442	-2,532,075
Environmental Impacts / Area					
Global Warming (kg CO_2eq/m^2)	699.4	6.272	2.204	100.4	14.85
Acidification (kg SO_2eq/m^2)	2.121	0.02906	0.02519	0.2361	0.03774
Eutrophication (kg Neq/m^2)	0.1316	0.002366	4.363E-004	0.01423	0.001835
Smog Formation (kg O_3eq/m^2)	40.86	0.9603	1.564	4.520	1.008
Ozone Depletion (kg CFC-11eq/m^2)	2.679E-006	2.148E-013	6.868E-013	8.991E-012	-8.285E-008
Primary Energy (MJ/m^2)	6,704	91.21	53.93	836.8	87.89
Non-renewable Energy (MJ/m^2)	6,256	89.02	51.79	782.4	111.3
Renewable Energy (MJ/m^2)	448.6	2.205	2.163	55.28	-24.1

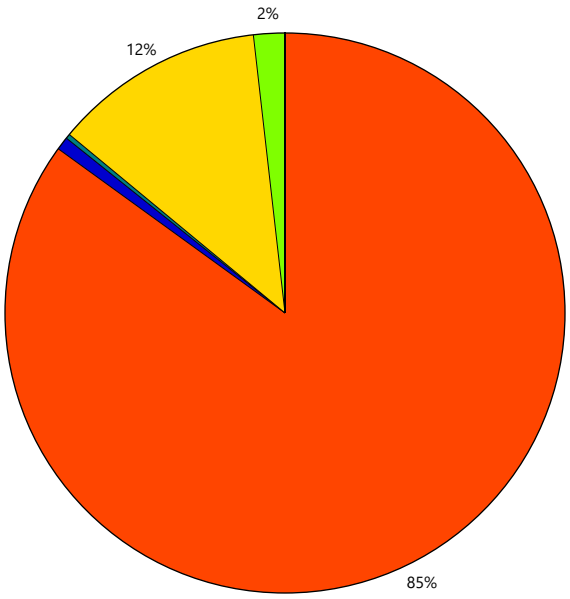
Results per Life Cycle Stage



Legend

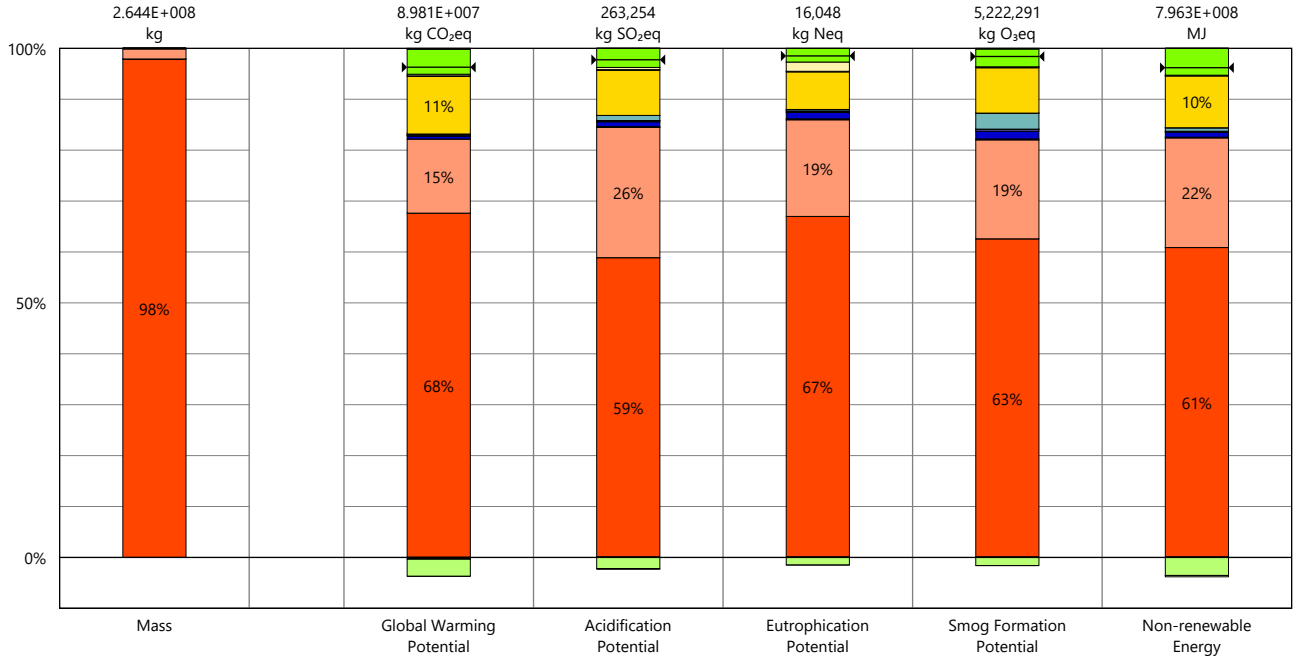
Life Cycle Stages

- Product [A1-A3]
- Transportation [A4]
- Maintenance and Replacement [B2-B5]
- End of Life [C2-C4]
- Module D [D]



Global Warming Potential

Results per Life Cycle Stage, itemized by Division



Legend

Net value (impacts + credits)

Product [A1-A3]
- 03 - Concrete
- 04 - Masonry
- 05 - Metals
- 06 - Wood/Plastics/Composites

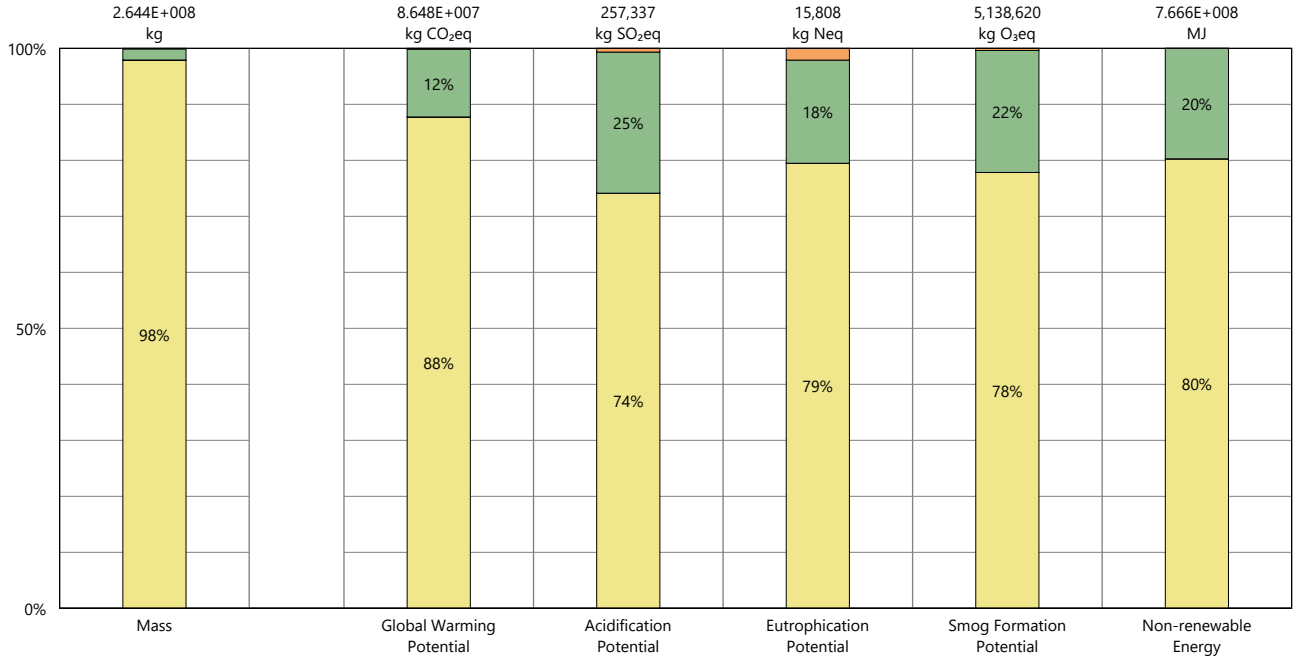
Transportation [A4]
- 03 - Concrete
- 04 - Masonry
- 05 - Metals
- 06 - Wood/Plastics/Composites

Maintenance and Replacement [B2-B5]
- 03 - Concrete
- 04 - Masonry
- 05 - Metals
- 06 - Wood/Plastics/Composites

End of Life [C2-C4]
- 03 - Concrete
- 04 - Masonry
- 05 - Metals
- 06 - Wood/Plastics/Composites

Module D [D]
- 03 - Concrete
- 04 - Masonry
- 05 - Metals
- 06 - Wood/Plastics/Composites

Results per Division



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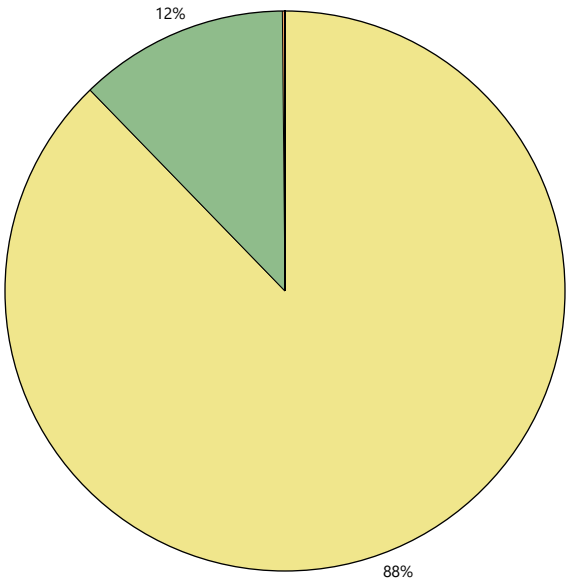
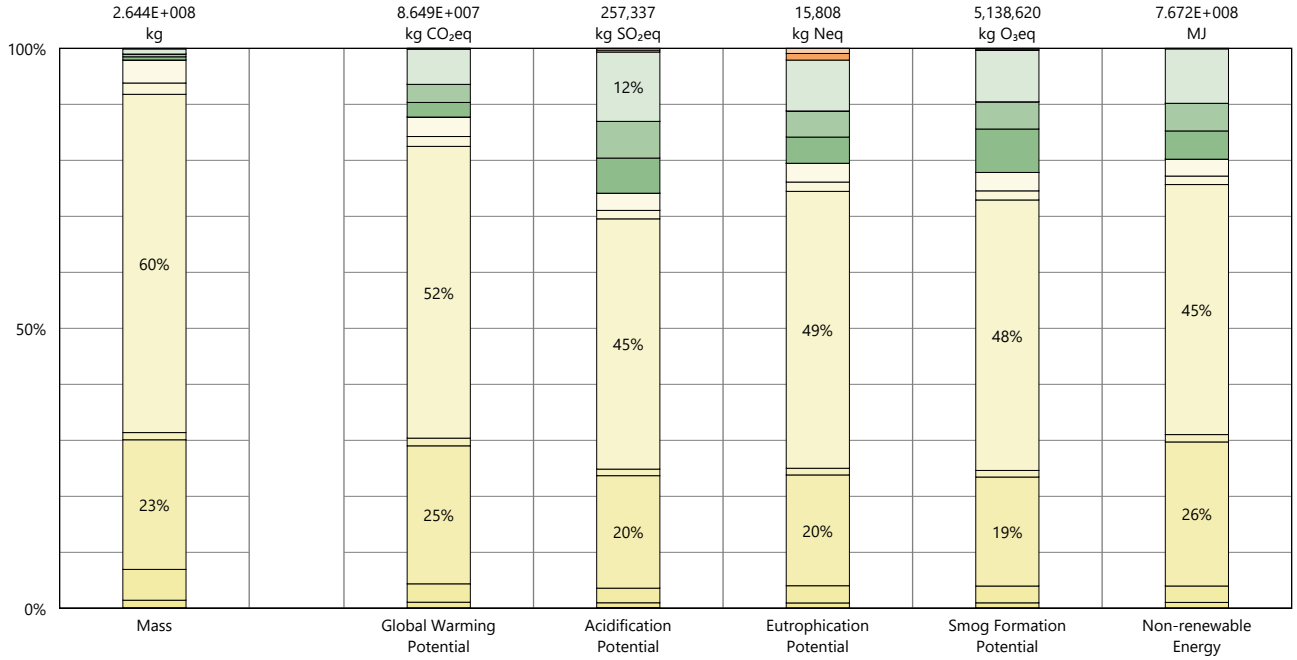
Divisions

- 03 - Concrete
- 04 - Masonry
- 05 - Metals
- 06 - Wood/Plastics/Composites



Global Warming Potential

Results per Division, itemized by Tally Entry



Legend

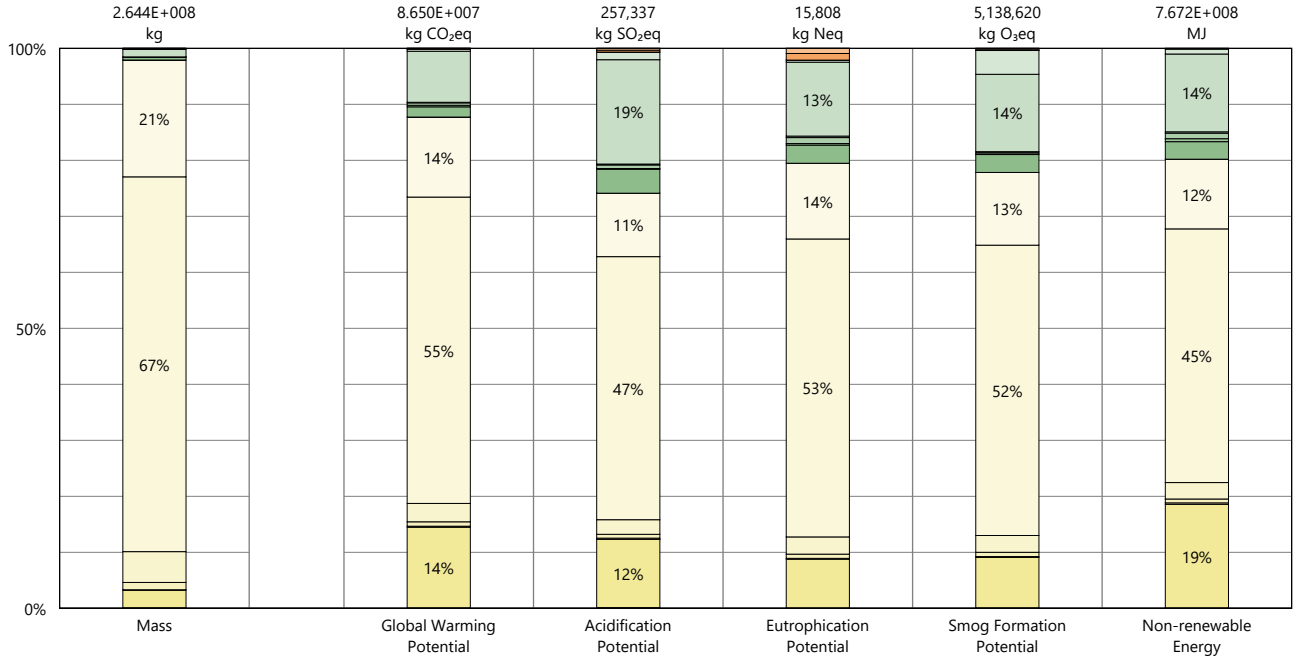
03 - Concrete
- Cast-in-place concrete, lightweight structural concrete, 3000 psi
- Cast-in-place concrete, structural concrete, 3000 psi
- Cast-in-place concrete, structural concrete, 4000 psi
- Cast-in-place concrete, structural concrete, 5000 psi
- Precast concrete column
- Precast concrete double-tee
- Precast concrete inverted-tee
- Precast concrete slab

04 - Masonry
- Hollow-core CMU

05 - Metals
- Steel, deck
- Steel, rectangular tubing
- Steel, rod
- Steel, W section (wide flange shape)

06 - Wood/Plastics/Composites
- Cross laminated timber (CLT)
- Glue laminated timber (Glulam)

Results per Division, itemized by Material



Legend

03 - Concrete

- Lightweight concrete, 3000 psi, North Central regional average
- Steel, concrete reinforcing steel, CMC - EPD
- Steel, reinforcing rod
- Steel, welded wire mesh
- Structural concrete, 3000 psi, 0% fly ash and slag
- Structural concrete, 4000 psi, North Central regional average
- Structural concrete, 5000 psi, 0% fly ash and slag
- Structural concrete, 5000 psi, North Central regional average

04 - Masonry

- Concrete masonry unit (CMU), hollow-core
- Mortar type S
- Paint, exterior acrylic latex
- Thickset mortar

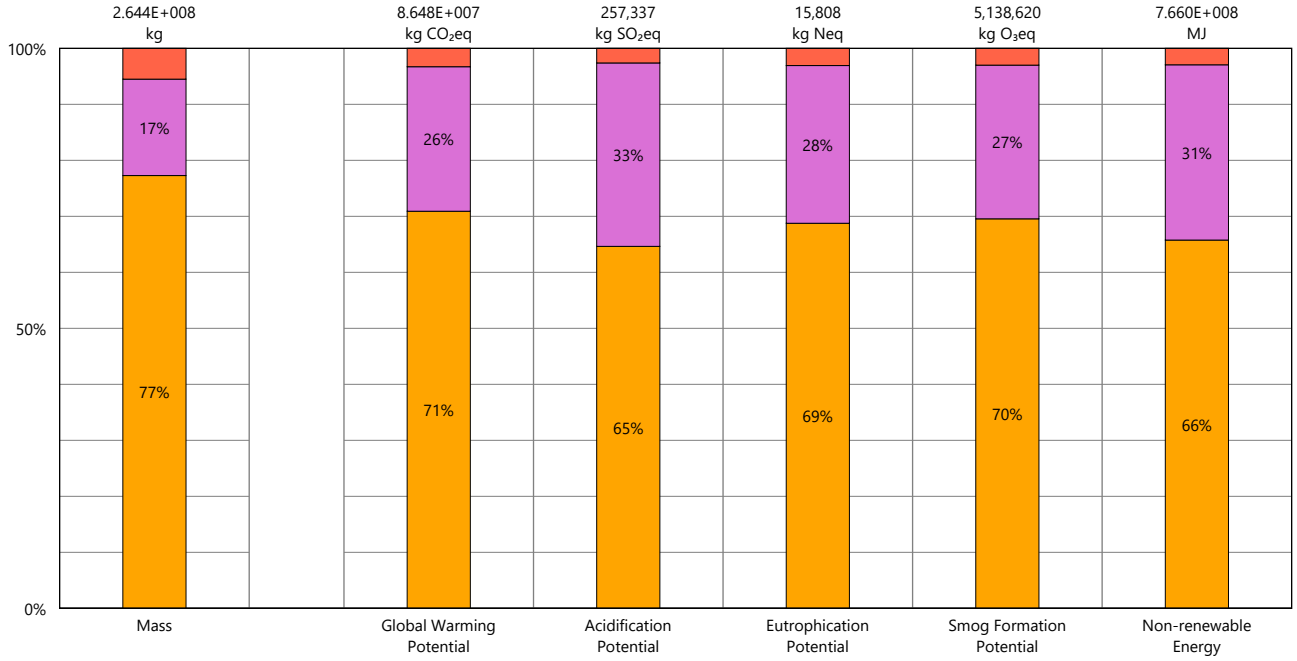
05 - Metals

- Coated steel deck, SDI - EPD
- Epoxy coating, metal stock
- Fireproofing, intumescent paint
- Fireproofing, intumescent paint, by area
- Galvanized steel
- Paint, enamel, solvent based
- Steel, reinforcing rod

06 - Wood/Plastics/Composites

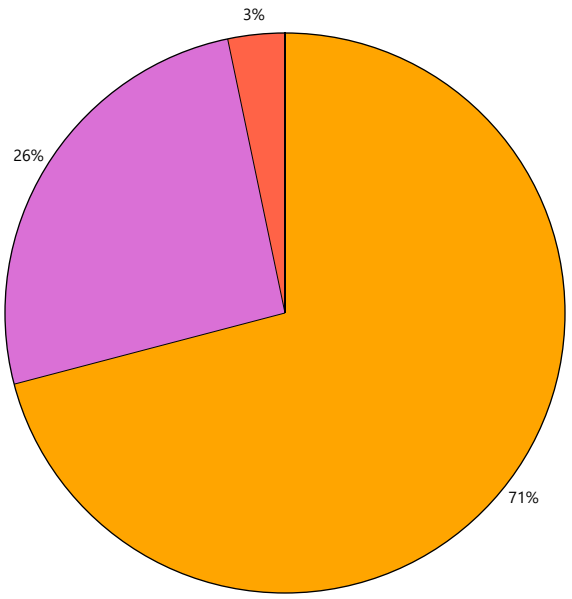
- CLT, KLH Massivholz, KLH Solid Timber Panels, 320 mm - EPD
- Glue laminated timber (Glulam), AWC - EPD
- Paint, exterior acrylic latex

Results per Revit Category



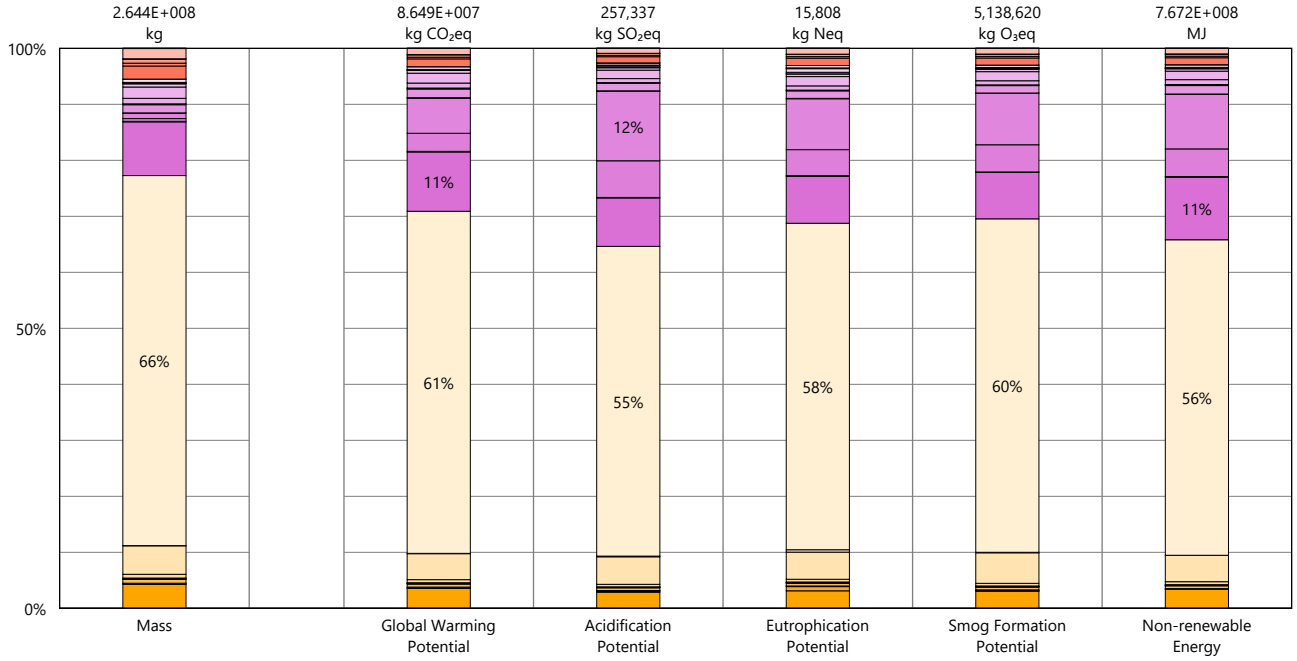
Legend

Revit Categories
- Floors
- Structure
- Walls



Global Warming Potential

Results per Revit Category, itemized by Family



Legend

Floors

- 150 CONCRETE S.O.G. (SOG1)
- 175 CLT
- 180 CONCRETE SLAB
- 200 CONCRETE SLAB
- 200 CONCRETE SLAB + 75 TOPPING
- 200 CONCRETE SLAB CAST-IN-PLACE
- 250 CONCRETE SLAB
- 300 CONCRETE SLAB
- 350 CONCRETE SLAB
- 500 CONCRETE SLAB
- 75 TOPPING ON 203 HOLLOWCORE SLAB
- 87 CLT
- 900 DP DOUBLE TEE PC BEAMS + 75MM TOPPING

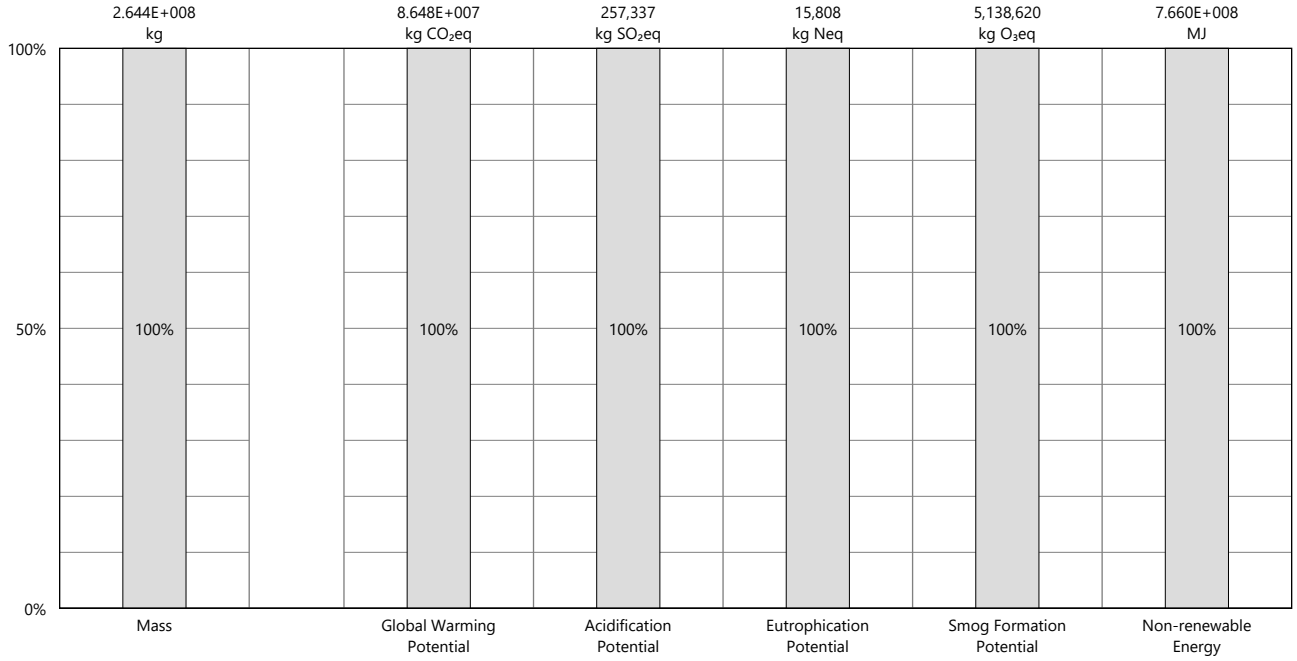
Structure

- 1500 DP MAT FOOTING
- 750 DP MAT FOOTING
- CISC HSS Rectangular(CSA G40.21)
- CISC Wide Flange Shapes
- CORBEL BEAM
- LEA_Concrete-Column
- LEA_Concrete-Rectangular Beam
- LEA_Concrete-Round-Column
- LEA_Footing-Rectangular
- LEA_Precast Girder Beam for Double Tee
- LEA_Precast Girder Beam for Double Tee (Single Ledge)
- LEA_Rod
- LEA_Timber_Sawn Column
- LEA_Timber_Solid Beam
- SF1 - 1500x750 DP.
- SF2 - 200 x 200 (RETAINING)
- SF3 - 1400 x 1000 (RETAINING)

Walls

- 300 THK PC
- 400 THK PC
- 500 THK PC
- 600 THK PC
- CONCRETE - 250
- CONCRETE - 300
- CONCRETE - 660
- MASONRY - 190

Results per Building Element



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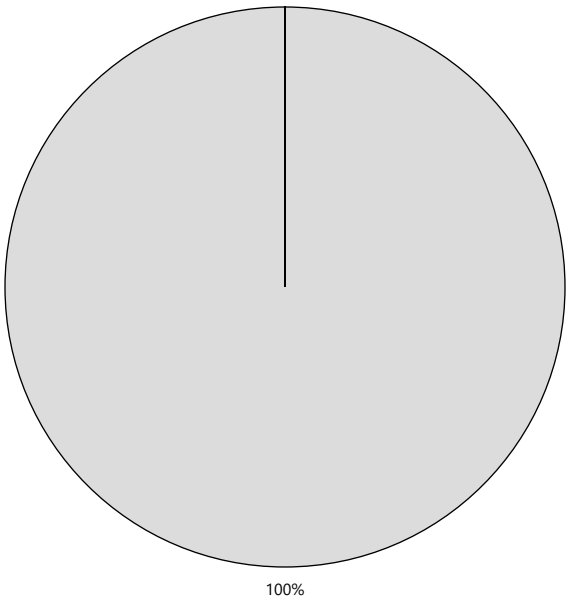
Building Elements

Undefined



Global Warming Potential

Calculation Methodology

LIFE CYCLE ASSESSMENT METHODS

The following provides a description of terms and methods associated with the use of Tally to conduct life cycle assessment for construction works and construction products. Tally methodology is consistent with LCA standards ISO 14040-14044, ISO 21930:2017, ISO 21931:2010, EN 15804:2012, and EN 15978:2011. For more information about LCA, please refer to these standards or visit www.choosetally.com.

Studied objects

The life cycle assessment (LCA) results reported represent an analysis of a single building, multiple buildings, or a comparative analysis of two or more building design options. The assessment may represent the complete architectural, structural, and finish systems of the building(s) or a subset of those systems. This may be used to compare the relative environmental impacts associated with building components or for comparative study with one or more reference buildings. Design options may represent a full or partial building across various stages of the design process, or they may represent multiple schemes of a full or partial building that are being compared to one another across a range of evaluation criteria.

Functional unit and reference unit

A functional unit is the quantified performance of a product, building, or system that defines the object of the study. The functional unit of a single building should include the building type (e.g. office, factory), relevant technical and functional requirements (e.g. regulatory requirements, energy performance), pattern of use (e.g. occupancy, usable floor area), and the required service life. For a design option comparison of a partial building, the functional unit is the complete set of building systems or products that perform a given function. It is the responsibility of the modeler to assure that reference buildings or design options are functionally equivalent in terms of scope and relevant performance. The expected life of the building has a default value of 60 years and can be modified by the modeler.

The reference unit is the full collection of processes and materials required to produce a building or portion thereof and is quantified according to the given goal and scope of the assessment over the full life of the building. If construction impacts are included in the assessment, the reference unit also includes the energy, water, and fuel consumed on the building site during construction. If operational energy is included in the assessment, the reference unit includes the electrical and thermal energy consumed on site over the life of the building.

Data source

Tally utilizes a custom designed LCA database that combines material attributes, assembly details, and architectural specifications with environmental impact data resulting from the collaboration between KieranTimberlake and thinkstep. LCA modeling was conducted in GaBi 8.5 using GaBi 2018 databases and in accordance with GaBi databases and modeling principles.

The data used are intended to represent the US and the year 2017. Where representative data were unavailable, proxy data were used. The datasets used, their geographic region, and year of reference are listed for each entry. An effort was made to choose proxy datasets that are technologically consistent with the relevant entry.

Data quality and uncertainty

Uncertainty in results can stem from both the data used and their application. Data quality is judged by: its measured, calculated, or estimated precision; its completeness, such as unreported emissions; its consistency, or degree of uniformity of the methodology applied on a study serving as a data source; and geographical, temporal, and technological representativeness. The GaBi LCI databases have been used in LCA models worldwide in both industrial and scientific applications. These LCI databases have additionally been used both as internal and critically reviewed and published studies. Uncertainty introduced by the use of proxy data is reduced by using technologically, geographically, and/or temporally similar data. It is the responsibility of the modeler to appropriately apply the predefined material entries to the building under study.

System boundaries and delimitations

The analysis accounts for the full cradle to grave life cycle of the design options studied across all life cycle stages, including material manufacturing, maintenance and replacement, and eventual end of life. Optionally, the construction impacts and operational energy of the building can be included within the scope. Product stage impacts are excluded for materials and components indicated as existing or salvaged by the modeler. The modeler defines whether the boundary includes or excludes the flow of biogenic carbon, which is the carbon absorbed and generated by biological sources (e.g. trees, algae) rather than from fossil resources.

Architectural materials and assemblies include all materials required for the product's manufacturing and use including hardware, sealants, adhesives, coatings, and finishing. The materials are included up to a 1% cut-off factor by mass except for known materials that have high environmental impacts at low levels. In these cases, a 1% cut-off was implemented by impact.

Calculation Methodology

LIFE CYCLE STAGES

The following describes the scope and system boudaries used to define each stage of the life cycle of a building or building product, from raw material acquisition to final disposal. For products listed in Tally as Environmental Product Declarations (EPD), the full life cycle impacts are included, even if the published EPD only includes the Product stage [A1-A3].

Product [EN 15978 A1 - A3]

This encompasses the full manufacturing stage, including raw material extraction and processing, intermediate transportation, and final manufacturing and assembly. The product stage scope is listed for each entry, detailing any specific inclusions or exclusions that fall outside of the cradle to gate scope. Infrastructure (buildings and machinery) required for the manufacturing and assembly of building materials are not included and are considered outside the scope of assessment.

Transportation [EN 15978 A4]

This counts transportation from the manufacturer to the building site during the construction stage and can be modified by the modeler.

Construction Installation [EN 15978 A5] (Optional)

This includes the anticipated or measured energy and water consumed on-site during the construction installation process, as specified by the modeler.

Maintenance and Replacement [EN 15978 B2-B5]

This encompasses the replacement of materials in accordance with their expected service life. This includes the end of life treatment of the existing products as well as the cradle to gate manufacturing and transportation to site of the replacement products. The service life is specified separately for each product. Refurbishment of materials marked as existing or salvaged by the modeler is also included.

Operational Energy [EN 15978 B6] (Optional)

This is based on the anticipated or measured energy and natural gas consumed at the building site over the lifetime of the building, as indicated by the modeler.

End of Life [EN 15978 C2-C4]

This includes the relevant material collection rates for recycling, processing requirements for recycled materials, incineration rates, and landfilling rates. The impacts associated with landfilling are based on average material properties, such as plastic waste, biodegradable waste, or inert material. Stage C2 encompasses the transport from the construction site to end-of-life treatment based on national averages. Stages C3-C4 account for waste processing and disposal, i.e., impacts associated with landfilling or incineration.

Module D [EN 15978 D]

This accounts for reuse potentials that fall beyond the system boundary, such as energy recovery and recycling of materials. Along with processing requirements, the recycling of materials is modeled using an avoided burden approach, where the burden of primary material production is allocated to the subsequent life cycle based on the quantity of recovered secondary material. Incineration of materials includes credit for average US energy recovery rates.

PRODUCT	CONSTRUCTION	USE	END-OF-LIFE	MODULE D
A1. Extraction	**A4. Transport (to site)**	B1. Use	C1. Demolition	**D. Benefits and loads beyond the system boundary from:**
A2. Transport (to factory)	***A5. Construction Installation***	**B2. Maintenance**	**C2. Transport (to disposal)**	**1. Reuse**
A3. Manufacturing		**B3. Repair**	**C3. Waste processing**	**2. Recycling**
		B4. Replacement	**C4. Disposal**	**3. Energy recovery**
		B5. Refurbishment		
		B6. Operational energy		
		B7. Operational water		

Life-Cycle Stages as defined by EN 15978. Processes included in Tally modeling scope are shown in bold. Italics indicate optional processes.

Calculation Methodology

ENVIRONMENTAL IMPACT CATEGORIES

A characterization scheme translates all emissions and fuel use associated with the reference flow into quantities of categorized environmental impact. As the degree that the emissions will result in environmental harm depends on regional ecosystem conditions and the location in which they occur, the results are reported as impact potential. Potential impacts are reported in kilograms of equivalent relative contribution (eq) of an emission commonly associated with that form of environmental impact (e.g. kg CO_2eq).

The following list provides a description of environmental impact categories reported according to the TRACI 2.1 characterization scheme, the environmental impact model developed by the US EPA to quantify environmental impact risk associated with emissions to the environment in the United States. TRACI is the standard environmental impact reporting format for LCA in North America. Impacts associated with land use change and fresh water depletion are not included in TRACI 2.1. For more information on TRACI 2.1, reference Bare 2010, EPA 2012, and Guinée 2001. For further description of measurement of environmental impacts in LCA, see Simonen 2014.

Acidification Potential (AP) kg SO_2eq

A measure of emissions that cause acidifying effects to the environment. The acidification potential is a measure of a molecule's capacity to increase the hydrogen ion (H^+) concentration in the presence of water, thus decreasing the pH value. Potential effects include fish mortality, forest decline, and the deterioration of building materials.

Eutrophication Potential (EP) kg Neq

A measure of the impacts of excessively high levels of macronutrients, the most important of which are nitrogen (N) and phosphorus (P). Nutrient enrichment may cause an undesirable shift in species composition and elevated biomass production in both aquatic and terrestrial ecosystems. In aquatic ecosystems, increased biomass production may lead to depressed oxygen levels caused by the additional consumption of oxygen in biomass decomposition.

Global Warming Potential (GWP) kg CO_2eq

A measure of greenhouse gas emissions, such as carbon dioxide and methane. These emissions are causing an increase in the absorption of radiation emitted by the earth, increasing the natural greenhouse effect. This may, in turn, have adverse impacts on ecosystem health, human health, and material welfare.

Ozone Depletion Potential (ODP) kg CFC-11eq

A measure of air emissions that contribute to the depletion of the stratospheric ozone layer. Depletion of the ozone leads to higher levels of UVB ultraviolet rays reaching the earth's surface with detrimental effects on humans and plants. As these impacts tend to be very small, ODP impacts can be difficult to calculate and are prone to a larger margin of error than the other impact categories.

Smog Formation Potential (SFP) kg O_3eq

A measure of ground level ozone, caused by various chemical reactions between nitrogen oxides (NO_x) and volatile organic compounds (VOCs) in sunlight. Human health effects can result in a variety of respiratory issues, including increasing symptoms of bronchitis, asthma, and emphysema. Permanent lung damage may result from prolonged exposure to ozone. Ecological impacts include damage to various ecosystems and crop damage.

Primary Energy Demand (PED) MJ (lower heating value)

A measure of the total amount of primary energy extracted from the earth. PED tracks energy resource use, not the environmental impacts associated with the resource use. PED is expressed in energy demand from non-renewable resources and from renewable resources. Efficiencies in energy conversion (e.g. power, heat, steam, etc.) are taken into account when calculating this result.

Non-Renewable Energy Demand MJ (lower heating value)

A measure of the energy extracted from non-renewable resources (e.g. petroleum, natural gas, etc.) contributing to the PED. Non-renewable resources are those that cannot be regenerated within a human time scale. Efficiencies in energy conversion (e.g. power, heat, steam, etc.) are taken into account when calculating this result.

Renewable Energy Demand MJ (lower heating value)

A measure of the energy extracted from renewable resources (e.g. hydropower, wind energy, solar power, etc.) contributing to the PED. Efficiencies in energy conversion (e.g. power, heat, steam, etc.) are taken into account when calculating this result.

LCI Data

END-OF-LIFE [C2-C4]

A Life Cycle Inventory(LCI) is a compilation and quantification of inputs and outputs for the reference unit.The following LCI provides a summary of all energy, construction, transportation, and material inputs present in the study. Materials are listed in alphabetical order along with a list of all Revit families and Tally entries in which they occur, along with any notes and system boundaries accompanying their database entries. Each entry lists the detailed scope for the LCI data sources used from the GaBi LCI database and identifies the LCI data source.

For LCI data sourced from an Environmental Product Declaration (EPD), the product manufacturer, EPD identification number, and Program Operator are listed. Where the LCI source does not provide data for all life cycle stages, default North American average values are used. This is of particular importance for European EPD sources, as EPD data are generally only provided for the product stage, and North American average values are used for the remaining life cycle stages.

Where specific quantities are associated with a data entry, such as user inputs, energy values, or material mass, the quantity is listed on the same line as the title of the entry.

TRANSPORTATION [A4]

Default transportation values are based on the three-digit material commodity code in the 2012 Commodity Flow Survey by the US Department of Transportation Bureau of Transportation Statistics and the US Department of Commerce where more specific industry-level transportation is not available.

Transportation by Barge

Scope:
The data set represents the transportation of 1 kg of material from the manufacturer location to the building site by barge.

LCI Source:
GLO: Average ship, 1500t payload capacity/ canal ts (2017)
US: Diesel mix at filling station ts (2014)

Transportation by Container Ship

Scope:
The data set represents the transportation of 1 kg of material from the manufacturer location to the building site by container ship.

LCI Source:
GLO: Container ship, 27500 dwt payload capacity, ocean going ts (2017)
US: Heavy fuel oil at refinery (0.3wt.% S) ts (2014)

Transportation by Rail

Scope:
The data set represents the transportation of 1 kg of material from the manufacturer location to the building site by cargo rail.

LCI Source:
GLO: Rail transport cargo - Diesel, average train, gross tonne weight 1000t / 726t payload capacity ts (2017)
US: Diesel mix at filling station ts (2014)

Transportation by Truck

Scope:
The data set represents the transportation of 1 kg of material from the manufacturer location to the building site by diesel truck.

LCI Source:
US: Truck - Trailer, basic enclosed / 45,000 lb payload - 8b ts (2017)
US: Diesel mix at filling station ts (2014)

LCI Data (continued)

END-OF-LIFE [C2-C4]

Specific end-of-life scenarios are detailed for each entry based on the US construction and demolition waste treatment methods and rates in the 2016 WARM Model by the US Environmental Protection Agency except where otherwise specified. Heterogeneous assemblies are modeled using the appropriate methodologies for the component materials.

End-of-Life Landfill

Scope:

Materials for which no recycling or incineration rates are known, no recycling occurs within the US at a commercial scale, or which are unable to be recycled are landfilled. This includes glass, drywall, insulation, and plastics. The solids contents of coatings, sealants, and paints are assumed to go to landfill, while the solvents or water evaporate during installation. Where the landfill contains biodegradable material, the energy recovered from landfill gas utilization is reflected as a credit in Module D.

LCI Source:

US: Glass/inert on landfill ts (2017)
US: Biodegradable waste on landfill, post-consumer ts (2017)
US: Plastic waste on landfill, post-consumer ts (2017)

Concrete End-of-Life

Scope:

Concrete (or other masonry products) are recycled into aggregate or general fill material or they are landfilled. It is assumed that 55% of the concrete is recycled. Module D accounts for both the credit associated with off-setting the production aggregate and the burden of the grinding energy required for processing.

LCI Source:

US: Diesel mix at refinery ts (2014)
GLO: Fork lifter (diesel consumption) ts (2016)
EU - 28 Gravel 2/32 ts (2017)
US: Glass/inert on landfill ts (2017)

Metals End-of-Life

Scope:

Metal products are modeled using the avoided burden approach. The recycling rate at end of life is used to determine how much secondary metal can be recovered after having subtracted any scrap input into manufacturing (net scrap). Net scrap results in an environmental credit in Module D for the corresponding share of the primary burden that can be allocated to the subsequent product system using secondary material as an input. If the value in Module D reflects an environmental burden, then the original product (A1-A3) contains more secondary material than is recovered.

LCI Source:

Aluminum - RNA: Primary Aluminum Ingot AA/ts (2010)
Aluminum - RNA: Secondary Aluminum Ingot AA/ts (2010)
Brass - GLO: Zinc mix ts (2012)
Brass - GLO: Copper (99.99% cathode) ICA (2013)
Brass - EU-28: Brass (CuZn20) ts (2017)
Copper - DE: Recycling potential copper sheet ts (2016)
Steel - GLO: Value of scrap worldsteel (2014)
Zinc - GLO: Special high grade zinc IZA (2012)

Wood End-of-Life

Scope:

End of Life waste treatment methods and rates for wood are based on the 2014 Municipal Solid Waste and Construction Demolition Wood Waste Generation and Recovery in the United States report by Dovetail Partners, Inc. It is assumed that 63.5% of wood is sent to landfill, 22% to incineration, and 14.5% to recovery.

LCI Source:

US: Untreated wood in waste incineration plant ts (2017)
US: Wood product (OSB, particle board) waste in waste incineration plant ts (2017)
US: Wood products (OSB, particle board) on landfill, post-consumer ts (2017)
US: Untreated wood on landfill, post-consumer ts (2017)
RNA: Softwood lumber CORRIM (2011)

LCI Data

MODEL ELEMENTS

Revit Categories
- Ceilings
- Curtainwall Mullions
- Curtainwall Panels
- Doors
- Floors
- Roofs
- Stairs and Railings
- Structure
- Walls
- Windows

22039_TOH Parking_R21_Struct_detached.rvt

Worksets
- CORBELS
- HIDDEN ELEMENTS FOR ARCH
- High Roof Framing - Grids/Timber Framing
- Links
- Model Elements
- P0 OPTION 1
- P0 OPTION 2
- Shared Views, Levels, Grids
- S-WALL ELEVATIONS

Phases
- Demolished
- Existing
- New Construction

TOH NCD P0 OPTION Parking Garage (Read-only)

Worksets
- N/A

Phases
- N/A

TOH NCD Parking Garage.rvt (Read-only)

Worksets
- N/A

Phases
- N/A

PRODUCT [A1-A3]

Materials and components are listed in alphabetical order along with a list of all Revit families and Tally entries in which they occur. The masses given here refer to the quantity of each material used over the building's life-cycle, which includes both Product [A1-A3] and Use [B2-B5] stages.

Additional provided data describing scope boundaries for each life cycle stage may be useful for interpretation of the impacts associated with the specific material or component. Each material or component is listed with its service life, or period of time after installation it is expected to meet the service requirements prior to replacement or repair. This value is indicated in parentheses next to the mass of the material associated with the listed Revit family. Values for transportation distance or service life shown with an asterisk (*) indicate user-defined changes to default values. Values for service life shown with a dagger (†) indicate materials identified by the modeler as existing or salvaged.

CLT, KLH Massivholz, KLH Solid Timber Panels, 320 mm - EPD **145,939.1 kg**

Used in the following Revit families:

175 CLT	93,506.3 kg (60 yrs)
87 CLT	52,432.9 kg (60 yrs)

Used in the following Tally entries:
- Cross laminated timber (CLT)

Description:
Solid cross-laminated timber boards by KLH. Appropriate for load-bearing, reinforced and non-load-bearing walls, ceilings and roofing elements. 320 mm thickness. EPD representative of Austrian (AT) conditions.

Life Cycle Inventory:
For information and quantities, see EPD

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 468 km

End-of-Life Scope:
14.5% Recovered
22% Incinerated with energy recovery
63.5% Landfilled (wood product waste)

Module D Scope:
Recovered wood products credited as avoided burden. Includes credits for recovered energy during manufacturing

LCI Source:
AT: KLH A1-A3 - 320 mm PE-EPD (2012)
AT: KLH D - 320 mm PE-EPD (2012)

EPD Source:
EPD-KLH-2012111-E

EPD Designation Holder:
KLH Massivholz GmbH

EPD Program Operator:
Institut Bauen und Umwelt (IBU)

EPD Expiration:
1/31/2017

Coated steel deck, SDI - EPD **1,281,432.8 kg**

Used in the following Revit families:

75 TOPPING ON 203 HOLLOWCORE SLAB	271,875.0 kg (60 yrs)
900 DP DOUBLE TEE PC BEAMS + 75MM TOPPING	1,009,557.7 kg (60 yrs)

Used in the following Tally entries:
- Steel, deck

Description:
Coated steel roof and floor deck panels, 1 ½" – 3" in depth and manufactured from 22 – 16 gage material. Industry-wide EPD from the Steel Deck Institute.

LCI Data (continued)

Life Cycle Inventory:
For information and quantities, see EPD

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 431 km

End-of-Life Scope:
98% Recovered
2% Landfilled (inert material)

Module D Scope:
Product has 28% scrap input while remainder is processed and credited as avoided burden.

LCI Source:
US: Steel deck - Steel deck institute (SDI) (A1-A3) ts (2012)

EPD Source:
4786052957.101.1

EPD Designation Holder:
Steel Deck Institute

EPD Program Operator:
UL Environment

EPD Expiration:
12/15/2020

Concrete masonry unit (CMU), hollow-core **566.5 kg**

Used in the following Revit families:

MASONRY - 190	566.5 kg (60 yrs)

Used in the following Tally entries:
Hollow-core CMU

Description:
Hollow-Core Concrete Masonry Unit (CMU), excludes grout and mortar

Life Cycle Inventory:
100% Concrete masonry units

Product Scope:
Cradle to gate, excludes mortar
Anchors, ties, and metal accessories outside of scope (<1% mass)

Transportation Distance:
By truck: 172 km

End-of-Life Scope:
55% Recycled into coarse aggregate
45% Landfilled (inert material)

Module D Scope:
Avoided burden credit for coarse aggregate, includes grinding energy

LCI Source:
DE: Concrete bricks (EN15804 A1-A3) ts (2017)

Epoxy coating, metal stock **20,960.1 kg**

Used in the following Revit families:

CISC HSS Rectangular(CSA G40.21)	2,513.3 kg (60 yrs*)
CISC Wide Flange Shapes	18,446.8 kg (60 yrs*)

Used in the following Tally entries:
Steel, rectangular tubing
Steel, W section (wide flange shape)

Description:
Epoxy coating, for metal stock

Life Cycle Inventory:
100% Epoxy coating

Product Scope:
Cradle to gate, includes application

Transportation Distance:
N/A

End-of-Life Scope:
100% Landfilled (inert waste)

LCI Source:
DE: Application base coat (automobile) ts (2017)
DE: Epoxy Resin (EP) mix ts (2017)

Fireproofing, intumescent paint **140,281.1 kg**

Used in the following Revit families:

75 TOPPING ON 203 HOLLOWCORE SLAB	29,762.7 kg (60 yrs)
900 DP DOUBLE TEE PC BEAMS + 75MM TOPPING	110,518.4 kg (60 yrs)

Used in the following Tally entries:
Steel, deck

Description:
Intumescent fireproof coating, for use on exposed structural steel. Default application rate assumes a thickness of 45 mils.

Life Cycle Inventory:
20% Titanium dioxide
5% Silica
10% Triamino triazine
10% Pentaerythritol
2% Amino methyl propanol
Less than 0.3% VOC emission

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 642 km

End-of-Life Scope:
100% Landfilled (inert waste)

LCI Source:
US: Electricity grid mix ts (2014)
DE: Polyethylene glycol (PEG) ts (2017)
US: Triethanolamine (TEA) ts (2017)
US: Titanium dioxide pigment ts (2017)
US: Silica sand (flour) ts (2017)
DE: Melamine ts (2017)
US: Tap water from groundwater ts (2017)

Fireproofing, intumescent paint, by area **35,140.9 kg**

Used in the following Revit families:

CISC Wide Flange Shapes	35,140.9 kg (60 yrs)

Used in the following Tally entries:
Steel, W section (wide flange shape)

Description:
Intumescent fireproof coating, for use on exposed structural steel.

Life Cycle Inventory:
20% Titanium dioxide
5% Silica
10% Triamino triazine
10% Pentaerythritol
2% Amino methyl propanol
Less than 0.3% VOC emission

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 642 km

End-of-Life Scope:
100% Landfilled (inert waste)

LCI Source:
US: Electricity grid mix ts (2014)
DE: Polyethylene glycol (PEG) ts (2017)
US: Triethanolamine (TEA) ts (2017)
US: Titanium dioxide pigment ts (2017)
US: Silica sand (flour) ts (2017)
DE: Melamine ts (2017)
US: Tap water from groundwater ts (2017)

LCI Data (continued)

Galvanized steel **3,678,397.2 kg**

Used in the following Revit families:
- CISC HSS Rectangular(CSA G40.21) 1,288,853.3 kg (60 yrs*)
- CISC Wide Flange Shapes 2,389,543.9 kg (60 yrs*)

Used in the following Tally entries:
Steel, rectangular tubing
Steel, W section (wide flange shape)

Description:
Hot dipped galvanized steel profile, for use with cladding systems.

Life Cycle Inventory:
100% Steel, hot dip galvanized

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 431 km

End-of-Life Scope:
98% Recovered
2% Landfilled (inert material)

Module D Scope:
Product has 44% scrap input while remainder is processed and credited as avoided burden

LCI Source:
RNA: Steel hot dip galvanized worldsteel (2007)
GLO: Steel sheet stamping and bending (5% loss) ts (2014)
US: Electricity grid mix ts (2014)
US: Lubricants at refinery ts (2014)
GLO: Compressed air 7 bar (medium power consumption) ts (2014)
US: Metal roll forming M CA (2010)
GLO: Value of scrap worldsteel (2014)

Glue laminated timber (Glulam), AWC - EPD **105,103.2 kg**

Used in the following Revit families:
- LEA_Timber_Sawn Column 31,541.1 kg (60 yrs*)
- LEA_Timber_Solid Beam 73,562.1 kg (60 yrs)

Used in the following Tally entries:
Glue laminated timber (Glulam)

Description:
Architectural grade structural glue-laminated timber (Glulam), an engineered wood product manufactured from end-joined, laminated, and planed lumber pressure-treated with resins. Typically used for beams, headers, columns, and arches. Entry inclusive of factory applied sealer. Industry-wide EPD from the American Wood Council.

Life Cycle Inventory:
For information and quantities, see EPD

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 468 km

End-of-Life Scope:
14.5% Recovered
22% Incinerated with energy recovery
63.5% Landfilled (wood product waste)

Module D Scope:
Recovered wood products credited as avoided burden.

LCI Source:
RNA: Glue laminated timbers CORRIM (2011)

EPD Source:
13CA24184.104.1

EPD Designation Holder:
American Wood Council and Canadian Wood Council

EPD Program Operator:
UL Environment

EPD Expiration:
4/16/2019

Lightweight concrete, 3000 psi, North Central regional average **246,520.8 kg**

Used in the following Revit families:
- CORBEL BEAM 246,520.8 kg (60 yrs)

Used in the following Tally entries:
Cast-in-place concrete, lightweight structural concrete, 3000 psi

Description:
Lightweight concrete, 3000 psi, North Central regional average. Mix design matches National Ready-Mix Concrete Association (NRMCA) Industry-wide EPD.

Life Cycle Inventory:
Sand: 45%, Expanded shale: 31%, Portland cement PCA - EPD: 12%, Water: 9%, Fly ash: 2%, Expanded slag: <1%, Admixture: <1%

Product Scope:
Cradle to gate
Anchors, ties, and metal accessories outside of scope (<1% mass)

Transportation Distance:
By truck: 24 km

End-of-Life Scope:
55% Recycled into coarse aggregate
45% Landfilled (inert material)

Module D Scope:
Avoided burden credit for coarse aggregate, includes grinding energy

LCI Source:
US: Portland cement PCA/ts (2014)
DE: Pumice gravel (grain size 4/16) (EN15804 A1-A3) ts (2017)
DE: Gravel (Grain size 2/32) (EN15804 A1-A3) s (2017)
DE: Fly ash (EN15804 A1-A3) ts (2017)
DE: Slag-tap granulate (EN15804 A1-A3) ts (2017)
DE: Expanded clay (EN15804 A1-A3) ts (2017)
DE: alcium nitrate ts (2017)
DE: Sodium ligninsulfonate ts (2017)
DE: Sodium naphtalene sulfonate [estimated] ts (2017)
US: Sodium hydroxide (caustic soda) ix (100%) ts (2017)
US: Colophony (rosin, refined) from CN pine gum rosin ts (2017)
US: Tap water from groundwater ts (2017)
US: Electricity grid mix s (2014)
US: Natural gas mix ts (2014)
US: Diesel mix at filling station (100% fossil) ts (2014)
US: Liquefied Petroleum Gas (LPG) (70% propane
30% utane) ts (2014)
US: Light fuel oil at refinery ts (2014)

Mortar type S **74.7 kg**

Used in the following Revit families:
- MASONRY - 190 74.7 kg (60 yrs)

Used in the following Tally entries:
Hollow-core CMU

Description:
Mortar Type S (medium strength mortar) for use with masonry walls and flooring.

Life Cycle Inventory:
Dried mix: 78% sand
17% cement
4% calcium hydroxide
1% limestone (12% water evaporates on drying)

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 172 km

End-of-Life Scope:
55% Recycled into coarse aggregate
45% Landfilled (inert material)

Module D Scope:
Avoided burden credit for coarse aggregate, includes grinding energy

LCI Source:
DE: Siliceous sand (grain size 0/2) ts (2017)
DE: Cement (CEM I 32.5) (EN15804 A1-A3) ts (2017)
DE: Gravel (Grain size 2/32) (EN15804 A1-A3) ts (2017)
US: Tap water from groundwater ts (2017)

LCI Data (continued)

Paint, enamel, solvent based **112,101.2 kg**

Used in the following Revit families:

75 TOPPING ON 203 HOLLOWCORE SLAB	23,783.9 kg (15 yrs)
900 DP DOUBLE TEE PC BEAMS + 75MM TOPPING	88,317.3 kg (15 yrs)

Used in the following Tally entries:
Steel, deck

Description:
Solvent-based enamel paint, appropriate for use on metals

Life Cycle Inventory:
17% Binding agent
16% Pigments and fillers
67% Solvent

Product Scope:
Cradle to gate, including emissions during application

Transportation Distance:
By truck: 642 km

End-of-Life Scope:
33% Solids landfilled (plastic waste)

LCI Source:
DE: Solvent paint white (EN15804 A1-A3) ts (2017)

Paint, exterior acrylic latex **3,795.7 kg**

Used in the following Revit families:

175 CLT	271.6 kg (60 yrs*)
87 CLT	306.4 kg (60 yrs*)
LEA_Timber_Sawn Column	958.1 kg (10 yrs)
LEA_Timber_Solid Beam	2,254.9 kg (10 yrs)
MASONRY - 190	4.7 kg (10 yrs)

Used in the following Tally entries:
Cross laminated timber (CLT)
Glue laminated timber (Glulam)
Hollow-core CMU

Description:
Acrylic-based latex paint for exterior applications. Associated reference table includes primer.

Life Cycle Inventory:
20.5% Binding agent
35% Pigments and fillers
40% Water
4.5% Organic solvents

Product Scope:
Cradle to gate, including emissions during application

Transportation Distance:
By truck: 642 km

End-of-Life Scope:
100% to landfill (plastic waste)

LCI Source:
DE: Application paint emulsion (building, exterior, white) ts (2017)

Steel, concrete reinforcing steel, CMC - EPD **8,416,165.1 kg**

Used in the following Revit families:

150 CONCRETE S.O.G. (SOG1)	426,905.7 kg (60 yrs)
1500 DP MAT FOOTING	2,767,245.4 kg (60 yrs)
180 CONCRETE SLAB	143.5 kg (60 yrs)
200 CONCRETE SLAB	14,071.5 kg (60 yrs)
200 CONCRETE SLAB + 75 TOPPING	18,270.3 kg (60 yrs)
200 CONCRETE SLAB CAST-IN-PLACE	7,175.2 kg (60 yrs)
250 CONCRETE SLAB	650.6 kg (60 yrs)
300 CONCRETE SLAB	7,818.6 kg (60 yrs)
350 CONCRETE SLAB	10,511.4 kg (60 yrs)
500 CONCRETE SLAB	65,718.7 kg (60 yrs)
75 TOPPING ON 203 HOLLOWCORE SLAB	134,153.7 kg (60 yrs)
750 DP MAT FOOTING	28,816.8 kg (60 yrs)
900 DP DOUBLE TEE PC BEAMS + 75MM TOPPING	4,294,617.5 kg (60 yrs)
LEA_Concrete-Column	275,349.3 kg (60 yrs)
LEA_Concrete-Rectangular Beam	27,470.5 kg (60 yrs)
LEA_Concrete-Round-Column	17,461.2 kg (60 yrs)
LEA_Footing-Rectangular	143,911.1 kg (60 yrs)
LEA_Precast Girder Beam for Double Tee	76,215.3 kg (60 yrs)
LEA_Precast Girder Beam for Double Tee (Single Ledge)	19,253.3 kg (60 yrs)
SF1 - 1500x750 DP.	14,987.8 kg (60 yrs)
SF2 - 200 x 200 (RETAINING)	8,449.5 kg (60 yrs)
SF3 - 1400 x 1000 (RETAINING)	56,968.2 kg (60 yrs)

Used in the following Tally entries:
Cast-in-place concrete, structural concrete, 3000 psi
Cast-in-place concrete, structural concrete, 5000 psi
Precast concrete column
Precast concrete double-tee
Precast concrete inverted-tee

Description:
Concrete reinforcing steel (rebar) by Commercial Metals Company. Appropriate for use as reinforcement in concrete. EPD representative of conditions in the US.

Life Cycle Inventory:
For information and quantities, see EPD

Product Scope:
Cradle-to-gate

Transportation Distance:
By truck: 431 km

End-of-Life Scope:
98% Recovered
2% Landfilled (inert material)

Module D Scope:
Product has 100% scrap input, burden reflects difference between recovered material and scrap input. Credit given for the avoided burden associated with recovered material.

LCI Source:
EPD (US), Commercial Metals Company (2015)

EPD Source:
EPD-012

EPD Designation Holder:
Commercial Metals Company (CMC)

EPD Program Operator:
ASTM International

EPD Expiration:
9/1/2020

Steel, reinforcing rod **2,058.3 kg**

Used in the following Revit families:

LEA_Footing-Rectangular	85.5 kg (60 yrs)
LEA_Rod	1,972.7 kg (60 yrs)

Used in the following Tally entries:
Precast concrete inverted-tee
Steel, rod

Description:
Common unfinished tempered steel rod suitable for structural reinforcement (rebar)

Life Cycle Inventory:
100% Steel rebar

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 431 km

End-of-Life Scope:
70% Recovered
30% Landfilled (inert material)

Module D Scope:
Product has a 16.4% scrap input while remainder is processed and credited as avoided burden.

LCI Source:
GLO: Steel rebar worldsteel (2014)

LCI Data (continued)

Steel, welded wire mesh **103,638.7 kg**

Used in the following Revit families:

200 CONCRETE SLAB + 75 TOPPING	12,070.5 kg (60 yrs)
75 TOPPING ON 203 HOLLOWCORE SLAB	91,568.2 kg (60 yrs)

Used in the following Tally entries:
Precast concrete slab

Description:
Steel rods further processed into wires appropriate for welded wire mesh reinforcement

Life Cycle Inventory:
100% Carbon steel wire

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 431 km

End-of-Life Scope:
98% Recovered
2% Landfilled (inert material)

Module D Scope:
Product has 16% scrap input while remainder is processed and credited as avoided burden

LCI Source:
GLO: Steel wire rod worldsteel (2014)
DE: Copper wire (0.6 mm) ts (2017)
US: Electricity grid mix ts (2014)
US: Thermal energy from natural gas ts (2014)

Structural concrete, 3000 psi, 0% fly ash and slag **3,453,275.8 kg**

Used in the following Revit families:

75 TOPPING ON 203 HOLLOWCORE SLAB	3,453,275.8 kg (60 yrs)

Used in the following Tally entries:
Cast-in-place concrete, structural concrete, 3000 psi

Description:
Structural concrete, 3000 psi, 0% fly ash and slag. Mix design matches National Ready-Mix Concrete Association (NRMCA) Industry-wide EPD.

Life Cycle Inventory:
Coarse aggregate: 44%, Sand: 36%, Portland cement PCA - EPD: 13%, Water: 7%, Admixture: <1%

Product Scope:
Cradle to gate
Anchors, ties, and metal accessories outside of scope (<1% mass)

Transportation Distance:
By truck: 24 km

End-of-Life Scope:
55% Recycled into coarse aggregate
45% Landfilled (inert material)

Module D Scope:
Avoided burden credit for coarse aggregate, includes grinding energy

LCI Source:
US: Portland cement PCA/ts (2014)
DE: Pumice gravel (grain size 4/16) (EN15804 A1-A3) ts (2017)
DE: Gravel (Grain size 2/32) (EN15804 A1-A3) s (2017)
DE: Fly ash (EN15804 A1-A3) ts (2017)
DE: Slag-tap granulate (EN15804 A1-A3) ts (2017)
DE: Expanded clay (EN15804 A1-A3) ts (2017)
DE: alcium nitrate ts (2017)
DE: Sodium ligninsulfonate ts (2017)
DE: Sodium naphtalene sulfonate [estimated] ts (2017)
US: Sodium hydroxide (caustic soda) ix (100%) ts (2017)
US: Colophony (rosin, refined) from CN pine gum rosin ts (2017)
US: Tap water from groundwater ts (2017)
US: Electricity grid mix s (2014)
US: Natural gas mix ts (2014)
US: Diesel mix at filling station (100% fossil) ts (2014)
US: Liquefied Petroleum Gas (LPG) (70% propane
30% utane) ts (2014)
US: Light fuel oil at refinery ts (2014)

Structural concrete, 4000 psi, North Central regional average **14,549,468.9 kg**

Used in the following Revit families:

300 THK PC	42,259.4 kg (60 yrs)
400 THK PC	6,168,376.0 kg (60 yrs)
500 THK PC	1,346,431.3 kg (60 yrs)
600 THK PC	1,828,628.4 kg (60 yrs)
CONCRETE - 250	236,971.2 kg (60 yrs)
CONCRETE - 300	4,825,839.2 kg (60 yrs)
CONCRETE - 660	100,963.3 kg (60 yrs)

Used in the following Tally entries:
Cast-in-place concrete, structural concrete, 4000 psi

Description:
Structural concrete, 4000 psi, North Central regional average. Mix design matches National Ready-Mix Concrete Association (NRMCA) Industry-wide EPD.

Life Cycle Inventory:
Coarse aggregate: 42%, Sand: 35%, Portland cement PCA - EPD: 12%, Water: 8%, Fly ash: 2%, Expanded slag: <1%, Admixture: <1%

Product Scope:
Cradle to gate
Anchors, ties, and metal accessories outside of scope (<1% mass)

Transportation Distance:
By truck: 24 km

End-of-Life Scope:
55% Recycled into coarse aggregate
45% Landfilled (inert material)

Module D Scope:
Avoided burden credit for coarse aggregate, includes grinding energy

LCI Source:
US: Portland cement PCA/ts (2014)
DE: Pumice gravel (grain size 4/16) (EN15804 A1-A3) ts (2017)
DE: Gravel (Grain size 2/32) (EN15804 A1-A3) s (2017)
DE: Fly ash (EN15804 A1-A3) ts (2017)
DE: Slag-tap granulate (EN15804 A1-A3) ts (2017)
DE: Expanded clay (EN15804 A1-A3) ts (2017)
DE: alcium nitrate ts (2017)
DE: Sodium ligninsulfonate ts (2017)
DE: Sodium naphtalene sulfonate [estimated] ts (2017)
US: Sodium hydroxide (caustic soda) ix (100%) ts (2017)
US: Colophony (rosin, refined) from CN pine gum rosin ts (2017)
US: Tap water from groundwater ts (2017)
US: Electricity grid mix s (2014)
US: Natural gas mix ts (2014)
US: Diesel mix at filling station (100% fossil) ts (2014)
US: Liquefied Petroleum Gas (LPG) (70% propane
30% utane) ts (2014)
US: Light fuel oil at refinery ts (2014)

Structural concrete, 5000 psi, 0% fly ash and slag **176,962,279.9 kg**

Used in the following Revit families:

200 CONCRETE SLAB + 75 TOPPING	1,250,756.1 kg (60 yrs)
75 TOPPING ON 203 HOLLOWCORE SLAB	9,488,389.7 kg (60 yrs)
900 DP DOUBLE TEE PC BEAMS + 75MM TOPPING	156,207,112.6 kg (60 yrs)
LEA_Concrete-Column	3,177,572.0 kg (60 yrs)
LEA_Footing-Rectangular	5,908.9 kg (60 yrs)
LEA_Precast Girder Beam for Double Tee	5,265,007.6 kg (60 yrs)
LEA_Precast Girder Beam for Double Tee (Single Ledge)	1,567,533.0 kg (60 yrs)

Used in the following Tally entries:
Precast concrete column
Precast concrete double-tee
Precast concrete inverted-tee
Precast concrete slab

Description:
Structural concrete, 5000 psi, 0% fly ash and slag. Mix design matches National Ready-Mix Concrete Association (NRMCA) Industry-wide EPD.

Life Cycle Inventory:
Coarse aggregate: 40%, Sand: 33%, Portland cement PCA - EPD: 20%, Water: 7%, Admixture: <1%

Product Scope:
Cradle to gate
Anchors, ties, and metal accessories outside of scope (<1% mass)

LCI Data (continued)

Transportation Distance:
By truck: 24 km

End-of-Life Scope:
55% Recycled into coarse aggregate
45% Landfilled (inert material)

Module D Scope:
Avoided burden credit for coarse aggregate, includes grinding energy

LCI Source:
US: Portland cement PCA/ts (2014)
DE: Pumice gravel (grain size 4/16) (EN15804 A1-A3) ts (2017)
DE: Gravel (Grain size 2/32) (EN15804 A1-A3) s (2017)
DE: Fly ash (EN15804 A1-A3) ts (2017)
DE: Slag-tap granulate (EN15804 A1-A3) ts (2017)
DE: Expanded clay (EN15804 A1-A3) ts (2017)
DE: alcium nitrate ts (2017)
DE: Sodium ligninsulfonate ts (2017)
DE: Sodium naphtalene sulfonate [estimated] ts (2017)
US: Sodium hydroxide (caustic soda) ix (100%) ts (2017)
US: Colophony (rosin, refined) from CN pine gum rosin ts (2017)
US: Tap water from groundwater ts (2017)
US: Electricity grid mix s (2014)
US: Natural gas mix ts (2014)
US: Diesel mix at filling station (100% fossil) ts (2014)
US: Liquefied Petroleum Gas (LPG) (70% propane
30% utane) ts (2014)
US: Light fuel oil at refinery ts (2014)

Structural concrete, 5000 psi, North Central regional average **55,155,948.0 kg**

Used in the following Revit families:

150 CONCRETE S.O.G. (SOG1)	10,964,106.8 kg (60 yrs)
1500 DP MAT FOOTING	22,579,802.4 kg (60 yrs)
180 CONCRETE SLAB	3,684.8 kg (60 yrs)
200 CONCRETE SLAB	361,395.4 kg (60 yrs)
200 CONCRETE SLAB + 75 TOPPING	469,231.9 kg (60 yrs)
200 CONCRETE SLAB CAST-IN-PLACE	184,279.4 kg (60 yrs)
250 CONCRETE SLAB	16,708.3 kg (60 yrs)
300 CONCRETE SLAB	200,802.5 kg (60 yrs)
350 CONCRETE SLAB	269,962.4 kg (60 yrs)
500 CONCRETE SLAB	1,687,835.1 kg (60 yrs)
750 DP MAT FOOTING	235,135.8 kg (60 yrs)
900 DP DOUBLE TEE PC BEAMS + 75MM TOPPING	13,022,764.4 kg (60 yrs)
LEA_Concrete-Column	392,864.8 kg (60 yrs)
LEA_Concrete-Rectangular Beam	224,150.5 kg (60 yrs)
LEA_Concrete-Round-Column	142,477.5 kg (60 yrs)
LEA_Footing-Rectangular	2,464,020.6 kg (60 yrs)
SF1 - 1500x750 DP.	256,618.4 kg (60 yrs)
SF2 - 200 x 200 (RETAINING)	217,007.3 kg (60 yrs)
SF3 - 1400 x 1000 (RETAINING)	1,463,099.7 kg (60 yrs)

Used in the following Tally entries:
Cast-in-place concrete, structural concrete, 5000 psi

Description:
Structural concrete, 5000 psi, North Central regional average. Mix design matches National Ready-Mix Concrete Association (NRMCA) Industry-wide EPD.

Life Cycle Inventory:
Coarse aggregate: 40%, Sand: 34%, Portland cement PCA - EPD: 15%, Water: 8%, Fly ash: 3%, Expanded slag: <1%, Admixture: <1%

Product Scope:
Cradle to gate
Anchors, ties, and metal accessories outside of scope (<1% mass)

Transportation Distance:
By truck: 24 km

End-of-Life Scope:
55% Recycled into coarse aggregate
45% Landfilled (inert material)

Module D Scope:
Avoided burden credit for coarse aggregate, includes grinding energy

LCI Source:
US: Portland cement PCA/ts (2014)
DE: Pumice gravel (grain size 4/16) (EN15804 A1-A3) ts (2017)
DE: Gravel (Grain size 2/32) (EN15804 A1-A3) s (2017)
DE: Fly ash (EN15804 A1-A3) ts (2017)
DE: Slag-tap granulate (EN15804 A1-A3) ts (2017)
DE: Expanded clay (EN15804 A1-A3) ts (2017)
DE: alcium nitrate ts (2017)
DE: Sodium ligninsulfonate ts (2017)
DE: Sodium naphtalene sulfonate [estimated] ts (2017)
US: Sodium hydroxide (caustic soda) ix (100%) ts (2017)
US: Colophony (rosin, refined) from CN pine gum rosin ts (2017)
US: Tap water from groundwater ts (2017)
US: Electricity grid mix s (2014)
US: Natural gas mix ts (2014)
US: Diesel mix at filling station (100% fossil) ts (2014)
US: Liquefied Petroleum Gas (LPG) (70% propane
30% utane) ts (2014)
US: Light fuel oil at refinery ts (2014)

Thickset mortar **611.7 kg**

Used in the following Revit families:

MASONRY - 190	611.7 kg (60 yrs)

Used in the following Tally entries:
Hollow-core CMU

Description:
Grout, for masonry

Life Cycle Inventory:
15% Cement
50% Sand
21% Gravel
14% Water

Product Scope:
Cradle to gate, excludes mortar
Anchors, ties, and metal accessories outside of scope (<1% mass)

Transportation Distance:
By truck: 172 km

End-of-Life Scope:
55% Recycled into coarse aggregate
45% Landfilled (inert material)

Module D Scope:
Avoided burden credit for coarse aggregate, includes grinding energy

LCI Source:
US: Portland cement PCA/ts (2014)
US: Tap water from groundwater ts (2017)
EU-28: Gravel 2/32 ts (2017)
US: Silica sand (Excavation and processing) ts (2017)

TOH Parking Garage

TOH parking - Tally Optimization Report

5/9/2022

tally®

Table of Contents

Report Summary

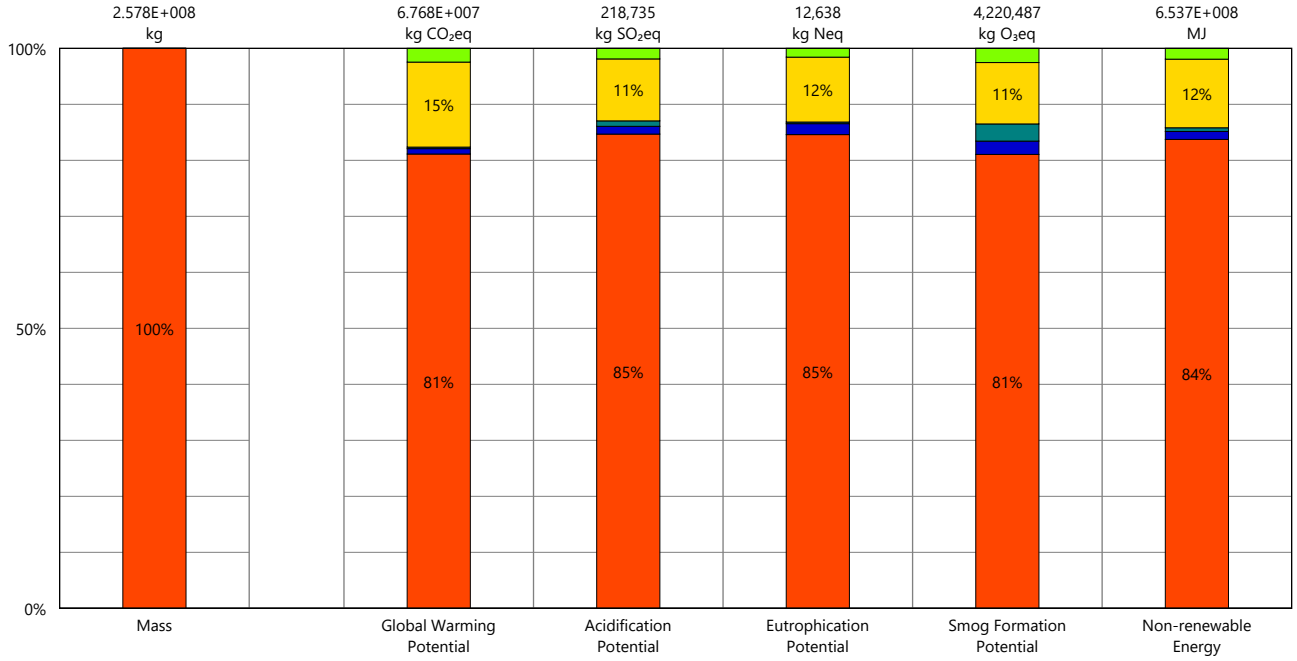
Created with Tally
Commercial Version 2022.04.08.01

Author	Nehal A.
Company	HDR
Date	5/9/2022
Project	TOH Parking Garage
Location	1053 Carling Avenue Ottawa, ON, K1Y 4E9
Gross Area	105063 m^2
Building Life	60 years
Boundaries	Cradle to grave, inclusive of biogenic carbon; see appendix for a full list of materials and processes

Goal and Scope of Assessment
The goal of this assessment is to optimize the EC in parking structure.

Environmental Impact Totals	Product Stage [A1-A3]	Construction Stage [A4]	Use Stage [B2-B5]	End of Life Stage [C2-C4]	Module D [D]
Global Warming (kg CO_2eq)	5.490E+007	654,929	183,521	1.027E+007	1,664,275
Acidification (kg SO_2eq)	185,233	3,035	2,131	24,201	4,136
Eutrophication (kg Neq)	10,691	247.1	36.63	1,464	199.0
Smog Formation (kg O_3eq)	3,420,948	100,278	129,423	462,739	107,098
Ozone Depletion (kg CFC-11eq)	0.2815	2.243E-008	7.860E-008	9.204E-007	-0.009482
Primary Energy (MJ)	5.821E+008	9,524,056	4,484,277	8.565E+007	1.014E+007
Non-renewable Energy (MJ)	5.474E+008	9,296,150	4,304,236	8.009E+007	1.265E+007
Renewable Energy (MJ)	3.489E+007	230,305	181,948	5,658,240	-2,580,228
Environmental Impacts / Area					
Global Warming (kg CO_2eq/m^2)	522.6	6.234	1.747	97.77	15.84
Acidification (kg SO_2eq/m^2)	1.763	0.02888	0.02028	0.2303	0.03936
Eutrophication (kg Neq/m^2)	0.1018	0.002352	3.486E-004	0.01393	0.001894
Smog Formation (kg O_3eq/m^2)	32.56	0.9545	1.232	4.404	1.019
Ozone Depletion (kg CFC-11eq/m^2)	2.679E-006	2.135E-013	7.482E-013	8.760E-012	-9.025E-008
Primary Energy (MJ/m^2)	5,541	90.65	42.68	815.3	96.54
Non-renewable Energy (MJ/m^2)	5,210	88.48	40.97	762.3	120.4
Renewable Energy (MJ/m^2)	332.1	2.192	1.732	53.86	-24.6

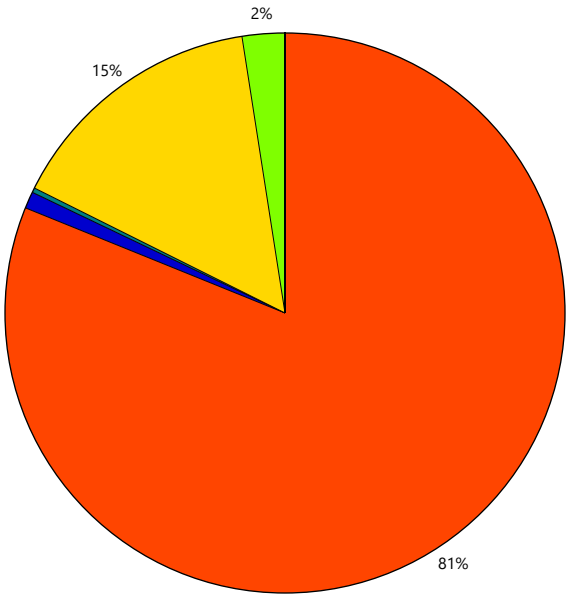
Results per Life Cycle Stage



Legend

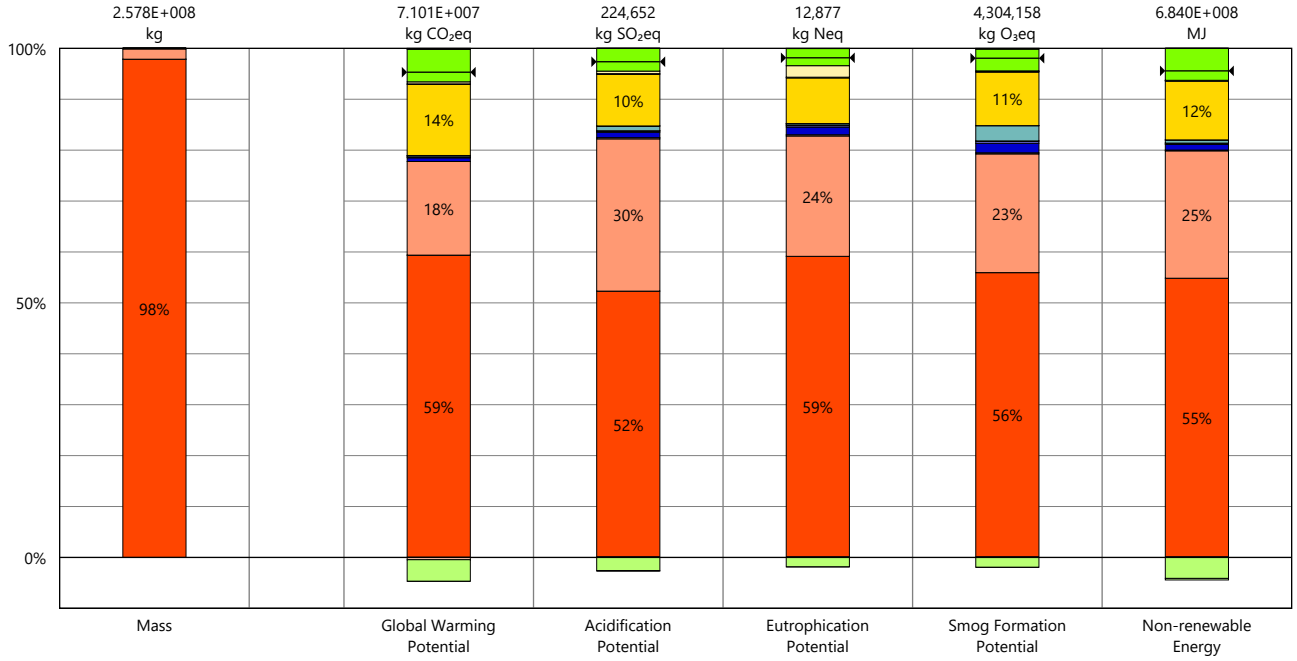
Life Cycle Stages

- Product [A1-A3]
- Transportation [A4]
- Maintenance and Replacement [B2-B5]
- End of Life [C2-C4]
- Module D [D]



Global Warming Potential

Results per Life Cycle Stage, itemized by Division



Legend

Net value (impacts + credits)

Product [A1-A3]
- 03 - Concrete
- 04 - Masonry
- 05 - Metals
- 06 - Wood/Plastics/Composites

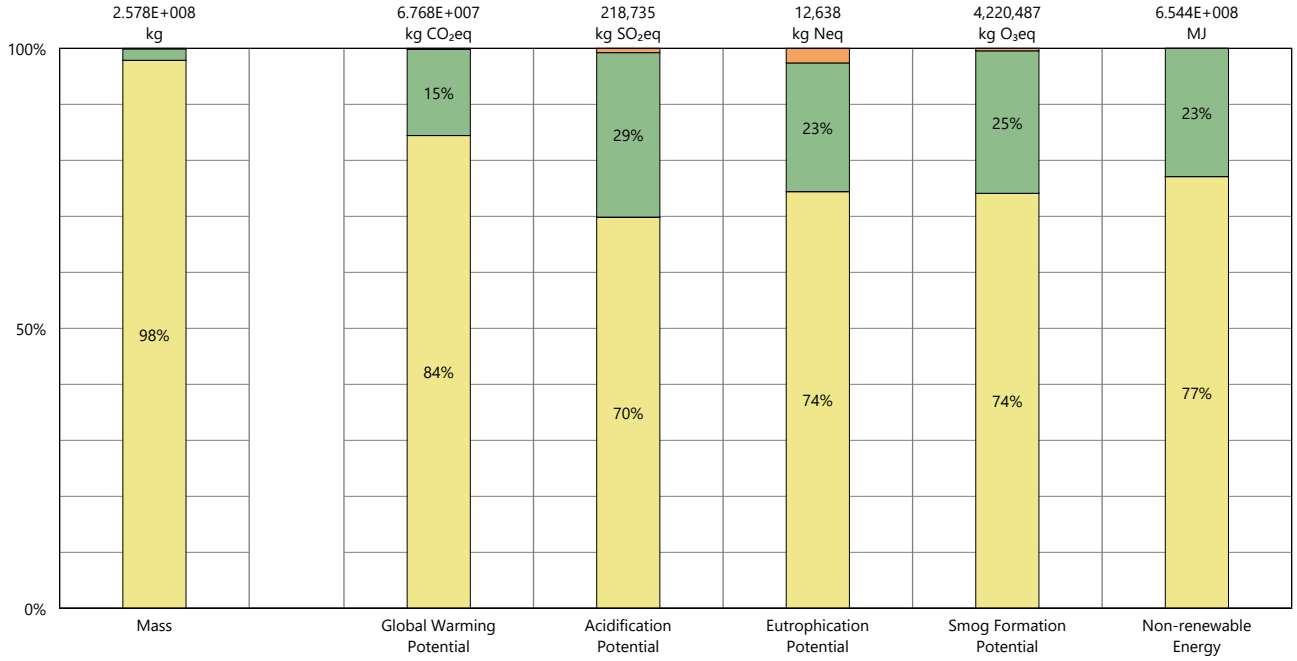
Transportation [A4]
- 03 - Concrete
- 04 - Masonry
- 05 - Metals
- 06 - Wood/Plastics/Composites

Maintenance and Replacement [B2-B5]
- 03 - Concrete
- 04 - Masonry
- 05 - Metals
- 06 - Wood/Plastics/Composites

End of Life [C2-C4]
- 03 - Concrete
- 04 - Masonry
- 05 - Metals
- 06 - Wood/Plastics/Composites

Module D [D]
- 03 - Concrete
- 04 - Masonry
- 05 - Metals
- 06 - Wood/Plastics/Composites

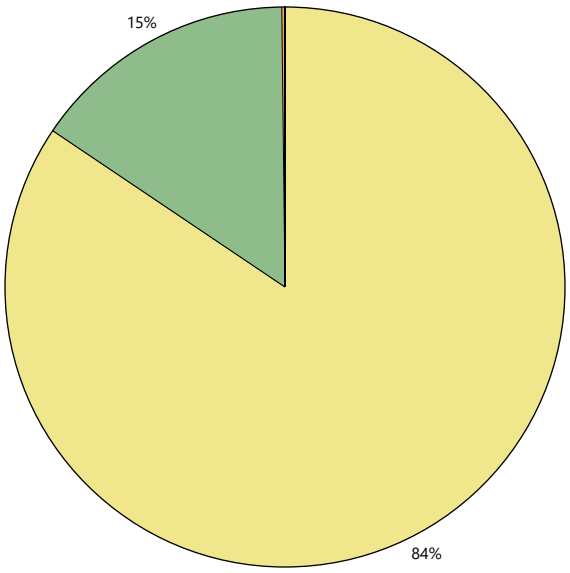
Results per Division



Legend

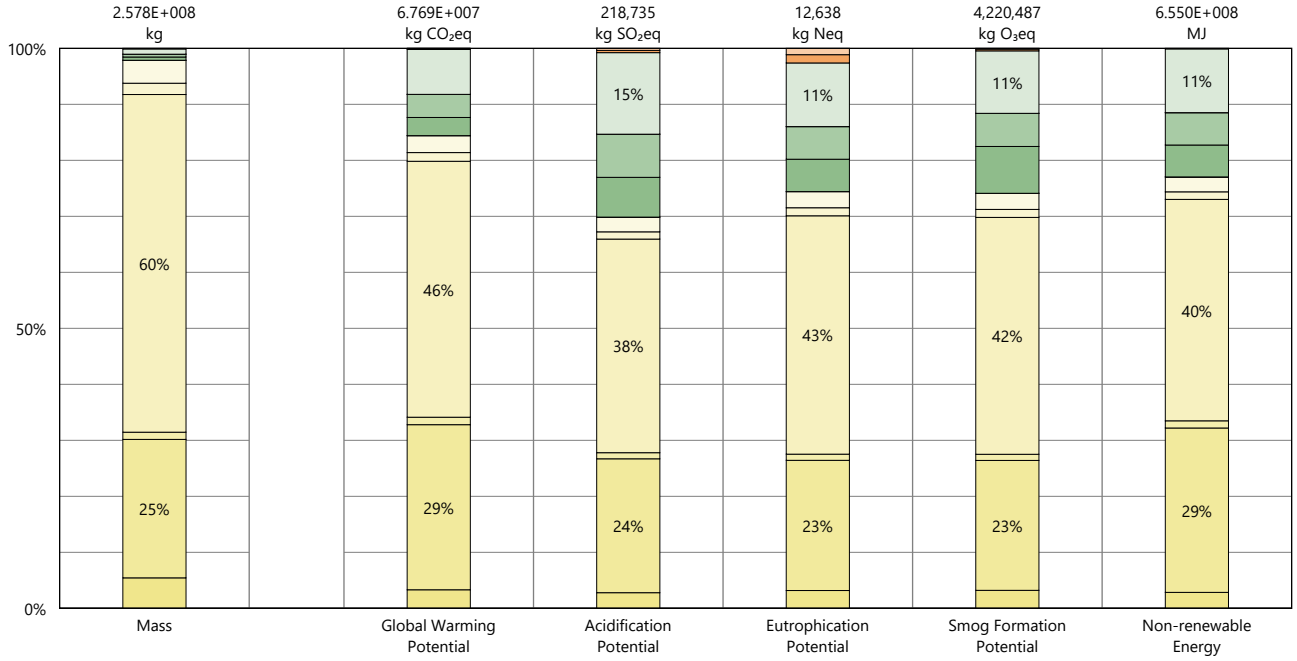
Divisions

- 03 - Concrete
- 04 - Masonry
- 05 - Metals
- 06 - Wood/Plastics/Composites



Global Warming Potential

Results per Division, itemized by Tally Entry



Legend

03 - Concrete

- Cast-in-place concrete, structural concrete, 4000 psi
- Cast-in-place concrete, structural concrete, 5000 psi
- Precast concrete column
- Precast concrete double-tee
- Precast concrete inverted-tee
- Precast concrete slab

04 - Masonry

- Hollow-core CMU

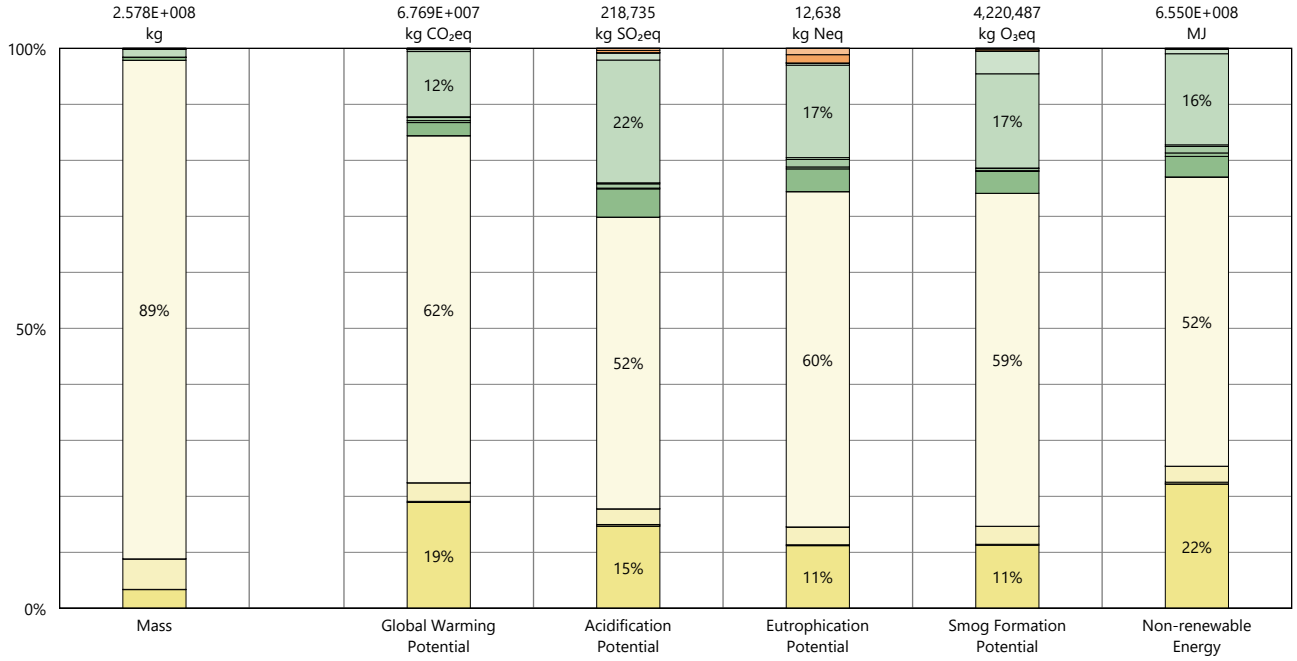
05 - Metals

- Steel, deck
- Steel, rectangular tubing
- Steel, rod
- Steel, W section (wide flange shape)

06 - Wood/Plastics/Composites

- Cross laminated timber (CLT)
- Glue laminated timber (Glulam)

Results per Division, itemized by Material



Legend

03 - Concrete

- Steel, concrete reinforcing steel, CMC - EPD
- Steel, reinforcing rod
- Steel, welded wire mesh
- Structural concrete, 4000 psi, 20% fly ash and 30% slag
- Structural concrete, 5000 psi, 0% fly ash and slag
- Structural concrete, 5000 psi, 20% fly ash and 30% slag

04 - Masonry

- Concrete masonry unit (CMU), hollow-core
- Mortar type S
- Paint, exterior acrylic latex
- Thickset mortar

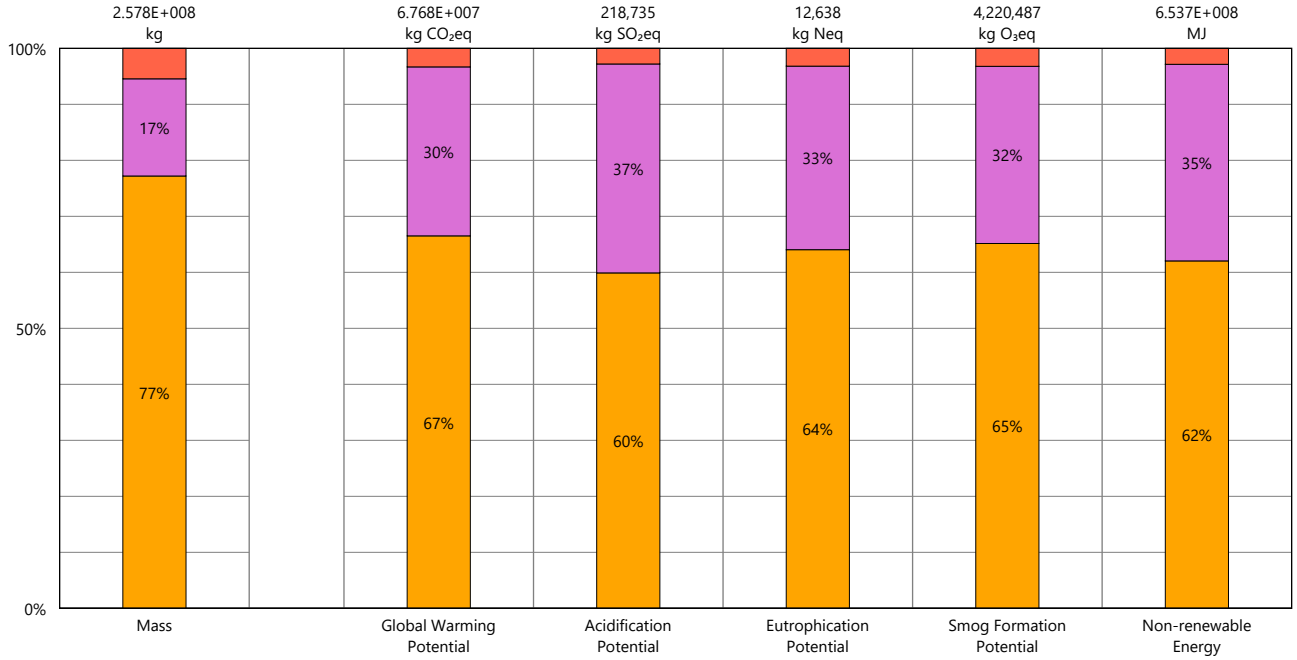
05 - Metals

- Coated steel deck, SDI - EPD
- Epoxy coating, metal stock
- Fireproofing, intumescent paint
- Fireproofing, intumescent paint, by area
- Galvanized steel
- Paint, enamel, solvent based
- Paint, exterior metal coating, silicone-based
- Steel, reinforcing rod

06 - Wood/Plastics/Composites

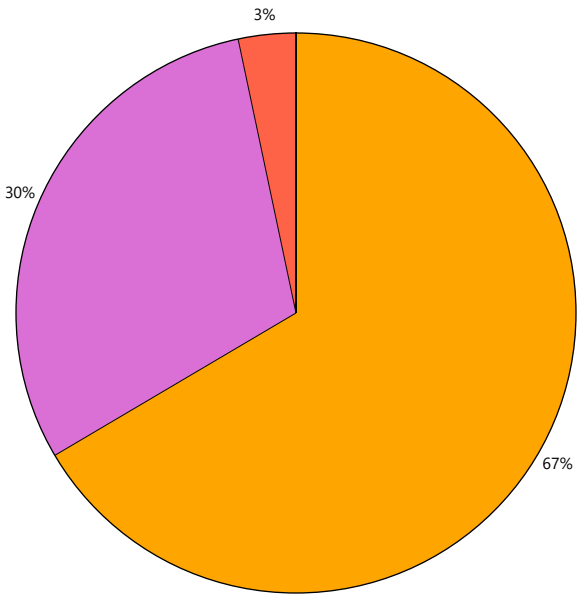
- CLT, KLH Massivholz, KLH Solid Timber Panels, 320 mm - EPD
- Glue laminated timber (Glulam), AWC - EPD
- Wood stain, water based

Results per Revit Category



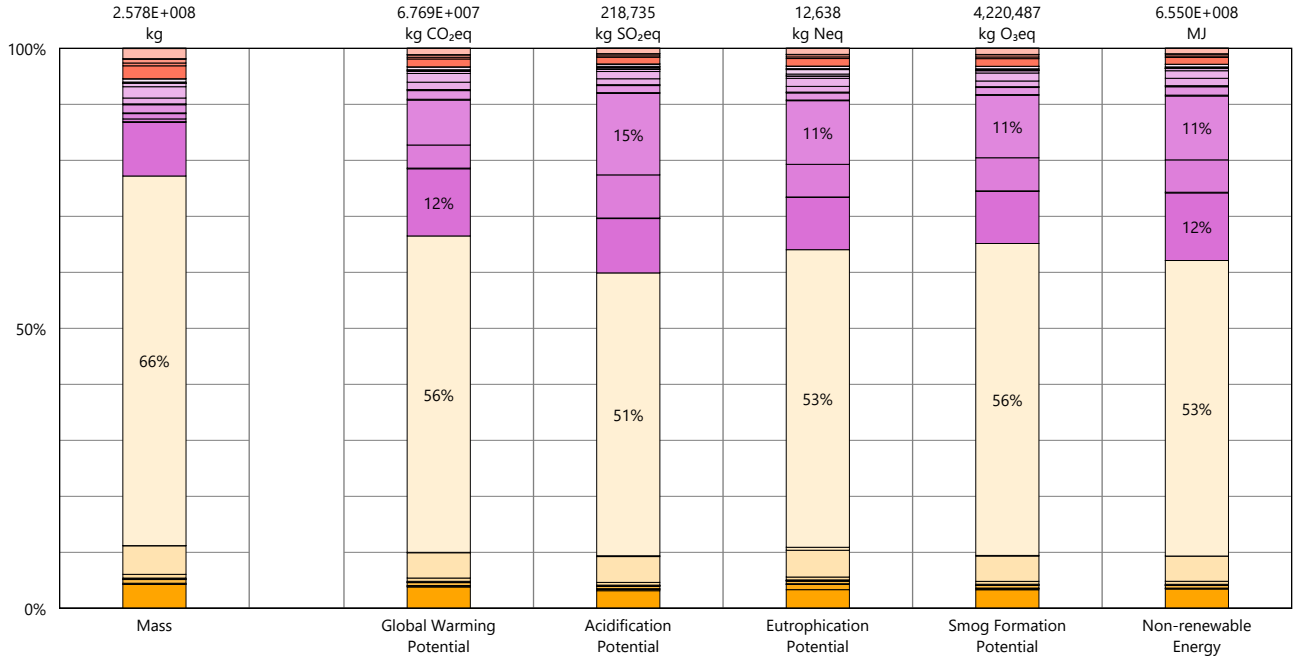
Legend

Revit Categories
- Floors
- Structure
- Walls



Global Warming Potential

Results per Revit Category, itemized by Family



Legend

Floors

- 150 CONCRETE S.O.G. (SOG1)
- 175 CLT
- 180 CONCRETE SLAB
- 200 CONCRETE SLAB
- 200 CONCRETE SLAB + 75 TOPPING
- 200 CONCRETE SLAB CAST-IN-PLACE
- 250 CONCRETE SLAB
- 300 CONCRETE SLAB
- 350 CONCRETE SLAB
- 500 CONCRETE SLAB
- 75 TOPPING ON 203 HOLLOWCORE SLAB
- 87 CLT
- 900 DP DOUBLE TEE PC BEAMS + 75MM TOPPING

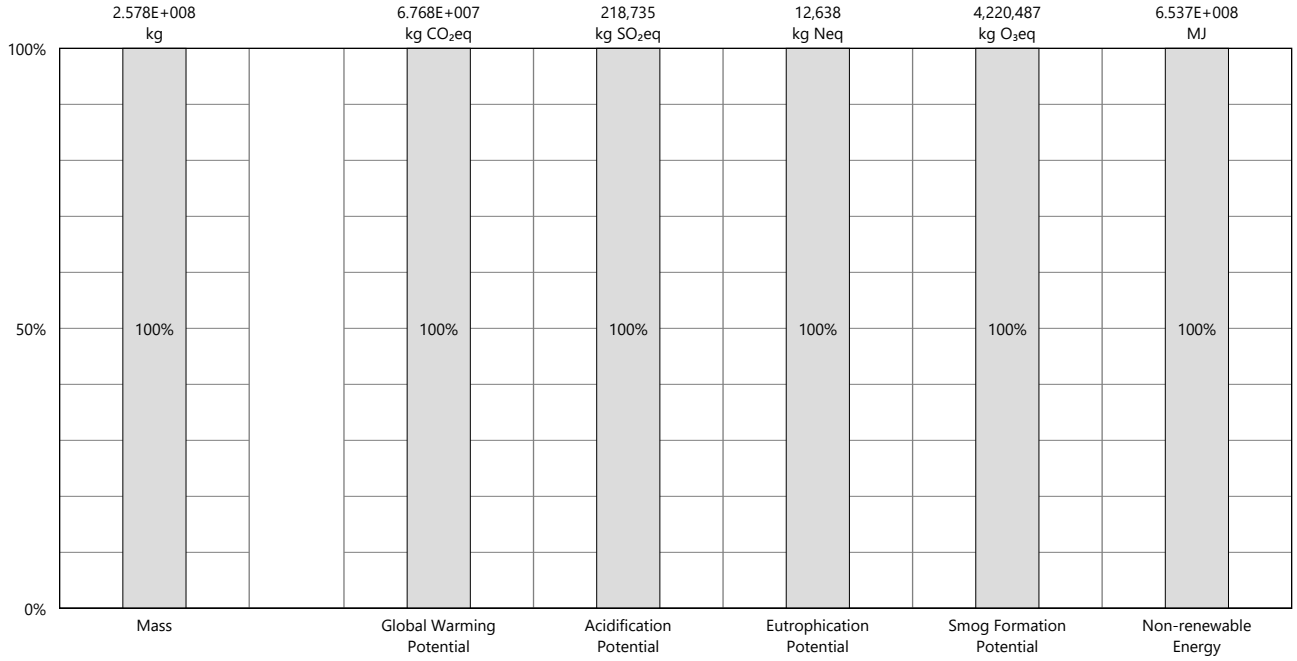
Structure

- 1500 DP MAT FOOTING
- 750 DP MAT FOOTING
- CISC HSS Rectangular(CSA G40.21)
- CISC Wide Flange Shapes
- CORBEL BEAM
- LEA_Concrete-Column
- LEA_Concrete-Rectangular Beam
- LEA_Concrete-Round-Column
- LEA_Footing-Rectangular
- LEA_Precast Girder Beam for Double Tee
- LEA_Precast Girder Beam for Double Tee (Single Ledge)
- LEA_Rod
- LEA_Timber_Sawn Column
- LEA_Timber_Solid Beam
- SF1 - 1500x750 DP.
- SF2 - 200 x 200 (RETAINING)
- SF3 - 1400 x 1000 (RETAINING)

Walls

- 300 THK PC
- 400 THK PC
- 500 THK PC
- 600 THK PC
- CONCRETE - 250
- CONCRETE - 300
- CONCRETE - 660
- MASONRY - 190

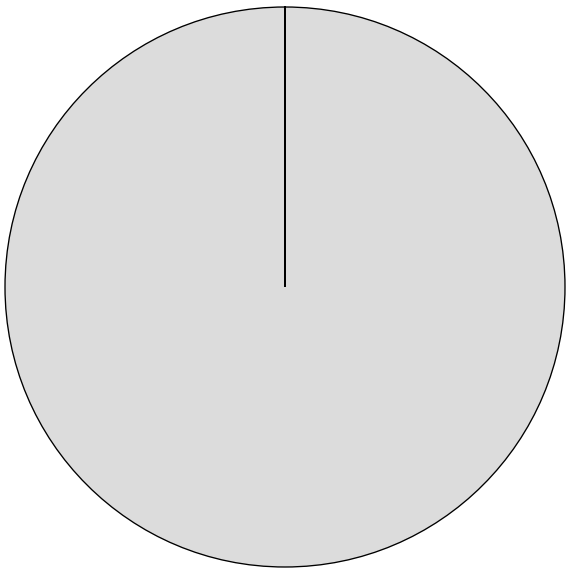
Results per Building Element



Legend

Building Elements

Undefined



Global Warming Potential

Calculation Methodology

LIFE CYCLE ASSESSMENT METHODS

The following provides a description of terms and methods associated with the use of Tally to conduct life cycle assessment for construction works and construction products. Tally methodology is consistent with LCA standards ISO 14040-14044, ISO 21930:2017, ISO 21931:2010, EN 15804:2012, and EN 15978:2011. For more information about LCA, please refer to these standards or visit www.choosetally.com.

Studied objects

The life cycle assessment (LCA) results reported represent an analysis of a single building, multiple buildings, or a comparative analysis of two or more building design options. The assessment may represent the complete architectural, structural, and finish systems of the building(s) or a subset of those systems. This may be used to compare the relative environmental impacts associated with building components or for comparative study with one or more reference buildings. Design options may represent a full or partial building across various stages of the design process, or they may represent multiple schemes of a full or partial building that are being compared to one another across a range of evaluation criteria.

Functional unit and reference unit

A functional unit is the quantified performance of a product, building, or system that defines the object of the study. The functional unit of a single building should include the building type (e.g. office, factory), relevant technical and functional requirements (e.g. regulatory requirements, energy performance), pattern of use (e.g. occupancy, usable floor area), and the required service life. For a design option comparison of a partial building, the functional unit is the complete set of building systems or products that perform a given function. It is the responsibility of the modeler to assure that reference buildings or design options are functionally equivalent in terms of scope and relevant performance. The expected life of the building has a default value of 60 years and can be modified by the modeler.

The reference unit is the full collection of processes and materials required to produce a building or portion thereof and is quantified according to the given goal and scope of the assessment over the full life of the building. If construction impacts are included in the assessment, the reference unit also includes the energy, water, and fuel consumed on the building site during construction. If operational energy is included in the assessment, the reference unit includes the electrical and thermal energy consumed on site over the life of the building.

Data source

Tally utilizes a custom designed LCA database that combines material attributes, assembly details, and architectural specifications with environmental impact data resulting from the collaboration between KieranTimberlake and thinkstep. LCA modeling was conducted in GaBi 8.5 using GaBi 2018 databases and in accordance with GaBi databases and modeling principles.

The data used are intended to represent the US and the year 2017. Where representative data were unavailable, proxy data were used. The datasets used, their geographic region, and year of reference are listed for each entry. An effort was made to choose proxy datasets that are technologically consistent with the relevant entry.

Data quality and uncertainty

Uncertainty in results can stem from both the data used and their application. Data quality is judged by: its measured, calculated, or estimated precision; its completeness, such as unreported emissions; its consistency, or degree of uniformity of the methodology applied on a study serving as a data source; and geographical, temporal, and technological representativeness. The GaBi LCI databases have been used in LCA models worldwide in both industrial and scientific applications. These LCI databases have additionally been used both as internal and critically reviewed and published studies. Uncertainty introduced by the use of proxy data is reduced by using technologically, geographically, and/or temporally similar data. It is the responsibility of the modeler to appropriately apply the predefined material entries to the building under study.

System boundaries and delimitations

The analysis accounts for the full cradle to grave life cycle of the design options studied across all life cycle stages, including material manufacturing, maintenance and replacement, and eventual end of life. Optionally, the construction impacts and operational energy of the building can be included within the scope. Product stage impacts are excluded for materials and components indicated as existing or salvaged by the modeler. The modeler defines whether the boundary includes or excludes the flow of biogenic carbon, which is the carbon absorbed and generated by biological sources (e.g. trees, algae) rather than from fossil resources.

Architectural materials and assemblies include all materials required for the product's manufacturing and use including hardware, sealants, adhesives, coatings, and finishing. The materials are included up to a 1% cut-off factor by mass except for known materials that have high environmental impacts at low levels. In these cases, a 1% cut-off was implemented by impact.

Calculation Methodology

LIFE CYCLE STAGES

The following describes the scope and system boudaries used to define each stage of the life cycle of a building or building product, from raw material acquisition to final disposal. For products listed in Tally as Environmental Product Declarations (EPD), the full life cycle impacts are included, even if the published EPD only includes the Product stage [A1-A3].

Product [EN 15978 A1 - A3]

This encompasses the full manufacturing stage, including raw material extraction and processing, intermediate transportation, and final manufacturing and assembly. The product stage scope is listed for each entry, detailing any specific inclusions or exclusions that fall outside of the cradle to gate scope. Infrastructure (buildings and machinery) required for the manufacturing and assembly of building materials are not included and are considered outside the scope of assessment.

Transportation [EN 15978 A4]

This counts transportation from the manufacturer to the building site during the construction stage and can be modified by the modeler.

Construction Installation [EN 15978 A5] (Optional)

This includes the anticipated or measured energy and water consumed on-site during the construction installation process, as specified by the modeler.

Maintenance and Replacement [EN 15978 B2-B5]

This encompasses the replacement of materials in accordance with their expected service life. This includes the end of life treatment of the existing products as well as the cradle to gate manufacturing and transportation to site of the replacement products. The service life is specified separately for each product. Refurbishment of materials marked as existing or salvaged by the modeler is also included.

Operational Energy [EN 15978 B6] (Optional)

This is based on the anticipated or measured energy and natural gas consumed at the building site over the lifetime of the building, as indicated by the modeler.

End of Life [EN 15978 C2-C4]

This includes the relevant material collection rates for recycling, processing requirements for recycled materials, incineration rates, and landfilling rates. The impacts associated with landfilling are based on average material properties, such as plastic waste, biodegradable waste, or inert material. Stage C2 encompasses the transport from the construction site to end-of-life treatment based on national averages. Stages C3-C4 account for waste processing and disposal, i.e., impacts associated with landfilling or incineration.

Module D [EN 15978 D]

This accounts for reuse potentials that fall beyond the system boundary, such as energy recovery and recycling of materials. Along with processing requirements, the recycling of materials is modeled using an avoided burden approach, where the burden of primary material production is allocated to the subsequent life cycle based on the quantity of recovered secondary material. Incineration of materials includes credit for average US energy recovery rates.

PRODUCT	CONSTRUCTION	USE	END-OF-LIFE	MODULE D
A1. Extraction	**A4. Transport (to site)**	B1. Use	C1. Demolition	**D. Benefits and loads beyond the system boundary from:**
A2. Transport (to factory)	***A5. Construction Installation***	**B2. Maintenance**	**C2. Transport (to disposal)**	**1. Reuse**
A3. Manufacturing		**B3. Repair**	**C3. Waste processing**	**2. Recycling**
		B4. Replacement	**C4. Disposal**	**3. Energy recovery**
		B5. Refurbishment		
		B6. Operational energy		
		B7. Operational water		

Life-Cycle Stages as defined by EN 15978. Processes included in Tally modeling scope are shown in bold. Italics indicate optional processes.

Calculation Methodology

ENVIRONMENTAL IMPACT CATEGORIES

A characterization scheme translates all emissions and fuel use associated with the reference flow into quantities of categorized environmental impact. As the degree that the emissions will result in environmental harm depends on regional ecosystem conditions and the location in which they occur, the results are reported as impact potential. Potential impacts are reported in kilograms of equivalent relative contribution (eq) of an emission commonly associated with that form of environmental impact (e.g. kg CO_2eq).

The following list provides a description of environmental impact categories reported according to the TRACI 2.1 characterization scheme, the environmental impact model developed by the US EPA to quantify environmental impact risk associated with emissions to the environment in the United States. TRACI is the standard environmental impact reporting format for LCA in North America. Impacts associated with land use change and fresh water depletion are not included in TRACI 2.1. For more information on TRACI 2.1, reference Bare 2010, EPA 2012, and Guinée 2001. For further description of measurement of environmental impacts in LCA, see Simonen 2014.

Acidification Potential (AP) kg SO_2eq

A measure of emissions that cause acidifying effects to the environment. The acidification potential is a measure of a molecule's capacity to increase the hydrogen ion (H^+) concentration in the presence of water, thus decreasing the pH value. Potential effects include fish mortality, forest decline, and the deterioration of building materials.

Eutrophication Potential (EP) kg Neq

A measure of the impacts of excessively high levels of macronutrients, the most important of which are nitrogen (N) and phosphorus (P). Nutrient enrichment may cause an undesirable shift in species composition and elevated biomass production in both aquatic and terrestrial ecosystems. In aquatic ecosystems, increased biomass production may lead to depressed oxygen levels caused by the additional consumption of oxygen in biomass decomposition.

Global Warming Potential (GWP) kg CO_2eq

A measure of greenhouse gas emissions, such as carbon dioxide and methane. These emissions are causing an increase in the absorption of radiation emitted by the earth, increasing the natural greenhouse effect. This may, in turn, have adverse impacts on ecosystem health, human health, and material welfare.

Ozone Depletion Potential (ODP) kg CFC-11eq

A measure of air emissions that contribute to the depletion of the stratospheric ozone layer. Depletion of the ozone leads to higher levels of UVB ultraviolet rays reaching the earth's surface with detrimental effects on humans and plants. As these impacts tend to be very small, ODP impacts can be difficult to calculate and are prone to a larger margin of error than the other impact categories.

Smog Formation Potential (SFP) kg O_3eq

A measure of ground level ozone, caused by various chemical reactions between nitrogen oxides (NO_x) and volatile organic compounds (VOCs) in sunlight. Human health effects can result in a variety of respiratory issues, including increasing symptoms of bronchitis, asthma, and emphysema. Permanent lung damage may result from prolonged exposure to ozone. Ecological impacts include damage to various ecosystems and crop damage.

Primary Energy Demand (PED) MJ (lower heating value)

A measure of the total amount of primary energy extracted from the earth. PED tracks energy resource use, not the environmental impacts associated with the resource use. PED is expressed in energy demand from non-renewable resources and from renewable resources. Efficiencies in energy conversion (e.g. power, heat, steam, etc.) are taken into account when calculating this result.

Non-Renewable Energy Demand MJ (lower heating value)

A measure of the energy extracted from non-renewable resources (e.g. petroleum, natural gas, etc.) contributing to the PED. Non-renewable resources are those that cannot be regenerated within a human time scale. Efficiencies in energy conversion (e.g. power, heat, steam, etc.) are taken into account when calculating this result.

Renewable Energy Demand MJ (lower heating value)

A measure of the energy extracted from renewable resources (e.g. hydropower, wind energy, solar power, etc.) contributing to the PED. Efficiencies in energy conversion (e.g. power, heat, steam, etc.) are taken into account when calculating this result.

LCI Data

END-OF-LIFE [C2-C4]

A Life Cycle Inventory(LCI) is a compilation and quantification of inputs and outputs for the reference unit.The following LCI provides a summary of all energy, construction, transportation, and material inputs present in the study. Materials are listed in alphabetical order along with a list of all Revit families and Tally entries in which they occur, along with any notes and system boundaries accompanying their database entries. Each entry lists the detailed scope for the LCI data sources used from the GaBi LCI database and identifies the LCI data source.

For LCI data sourced from an Environmental Product Declaration (EPD), the product manufacturer, EPD identification number, and Program Operator are listed. Where the LCI source does not provide data for all life cycle stages, default North American average values are used. This is of particular importance for European EPD sources, as EPD data are generally only provided for the product stage, and North American average values are used for the remaining life cycle stages.

Where specific quantities are associated with a data entry, such as user inputs, energy values, or material mass, the quantity is listed on the same line as the title of the entry.

TRANSPORTATION [A4]

Default transportation values are based on the three-digit material commodity code in the 2012 Commodity Flow Survey by the US Department of Transportation Bureau of Transportation Statistics and the US Department of Commerce where more specific industry-level transportation is not available.

Transportation by Barge

Scope:
The data set represents the transportation of 1 kg of material from the manufacturer location to the building site by barge.

LCI Source:
GLO: Average ship, 1500t payload capacity/ canal ts (2017)
US: Diesel mix at filling station ts (2014)

Transportation by Container Ship

Scope:
The data set represents the transportation of 1 kg of material from the manufacturer location to the building site by container ship.

LCI Source:
GLO: Container ship, 27500 dwt payload capacity, ocean going ts (2017)
US: Heavy fuel oil at refinery (0.3wt.% S) ts (2014)

Transportation by Rail

Scope:
The data set represents the transportation of 1 kg of material from the manufacturer location to the building site by cargo rail.

LCI Source:
GLO: Rail transport cargo - Diesel, average train, gross tonne weight 1000t / 726t payload capacity ts (2017)
US: Diesel mix at filling station ts (2014)

Transportation by Truck

Scope:
The data set represents the transportation of 1 kg of material from the manufacturer location to the building site by diesel truck.

LCI Source:
US: Truck - Trailer, basic enclosed / 45,000 lb payload - 8b ts (2017)
US: Diesel mix at filling station ts (2014)

LCI Data (continued)

END-OF-LIFE [C2-C4]

Specific end-of-life scenarios are detailed for each entry based on the US construction and demolition waste treatment methods and rates in the 2016 WARM Model by the US Environmental Protection Agency except where otherwise specified. Heterogeneous assemblies are modeled using the appropriate methodologies for the component materials.

End-of-Life Landfill

Scope:

Materials for which no recycling or incineration rates are known, no recycling occurs within the US at a commercial scale, or which are unable to be recycled are landfilled. This includes glass, drywall, insulation, and plastics. The solids contents of coatings, sealants, and paints are assumed to go to landfill, while the solvents or water evaporate during installation. Where the landfill contains biodegradable material, the energy recovered from landfill gas utilization is reflected as a credit in Module D.

LCI Source:

US: Glass/inert on landfill ts (2017)
US: Biodegradable waste on landfill, post-consumer ts (2017)
US: Plastic waste on landfill, post-consumer ts (2017)

Concrete End-of-Life

Scope:

Concrete (or other masonry products) are recycled into aggregate or general fill material or they are landfilled. It is assumed that 55% of the concrete is recycled. Module D accounts for both the credit associated with off-setting the production aggregate and the burden of the grinding energy required for processing.

LCI Source:

US: Diesel mix at refinery ts (2014)
GLO: Fork lifter (diesel consumption) ts (2016)
EU - 28 Gravel 2/32 ts (2017)
US: Glass/inert on landfill ts (2017)

Metals End-of-Life

Scope:

Metal products are modeled using the avoided burden approach. The recycling rate at end of life is used to determine how much secondary metal can be recovered after having subtracted any scrap input into manufacturing (net scrap). Net scrap results in an environmental credit in Module D for the corresponding share of the primary burden that can be allocated to the subsequent product system using secondary material as an input. If the value in Module D reflects an environmental burden, then the original product (A1-A3) contains more secondary material than is recovered.

LCI Source:

Aluminum - RNA: Primary Aluminum Ingot AA/ts (2010)
Aluminum - RNA: Secondary Aluminum Ingot AA/ts (2010)
Brass - GLO: Zinc mix ts (2012)
Brass - GLO: Copper (99.99% cathode) ICA (2013)
Brass - EU-28: Brass (CuZn20) ts (2017)
Copper - DE: Recycling potential copper sheet ts (2016)
Steel - GLO: Value of scrap worldsteel (2014)
Zinc - GLO: Special high grade zinc IZA (2012)

Wood End-of-Life

Scope:

End of Life waste treatment methods and rates for wood are based on the 2014 Municipal Solid Waste and Construction Demolition Wood Waste Generation and Recovery in the United States report by Dovetail Partners, Inc. It is assumed that 63.5% of wood is sent to landfill, 22% to incineration, and 14.5% to recovery.

LCI Source:

US: Untreated wood in waste incineration plant ts (2017)
US: Wood product (OSB, particle board) waste in waste incineration plant ts (2017)
US: Wood products (OSB, particle board) on landfill, post-consumer ts (2017)
US: Untreated wood on landfill, post-consumer ts (2017)
RNA: Softwood lumber CORRIM (2011)

LCI Data

MODEL ELEMENTS

Revit Categories
- Ceilings
- Curtainwall Mullions
- Curtainwall Panels
- Doors
- Floors
- Roofs
- Stairs and Railings
- Structure
- Walls
- Windows

22039_TOH Parking_R21_Struct_detached.rvt

Worksets
- CORBELS
- HIDDEN ELEMENTS FOR ARCH
- High Roof Framing - Grids/Timber Framing
- Links
- Model Elements
- P0 OPTION 1
- P0 OPTION 2
- Shared Views, Levels, Grids
- S-WALL ELEVATIONS

Phases
- Demolished
- Existing
- New Construction

TOH NCD P0 OPTION Parking Garage (Read-only)

Worksets
- N/A

Phases
- N/A

TOH NCD Parking Garage.rvt (Read-only)

Worksets
- N/A

Phases
- N/A

PRODUCT [A1-A3]

Materials and components are listed in alphabetical order along with a list of all Revit families and Tally entries in which they occur. The masses given here refer to the quantity of each material used over the building's life-cycle, which includes both Product [A1-A3] and Use [B2-B5] stages.

Additional provided data describing scope boundaries for each life cycle stage may be useful for interpretation of the impacts associated with the specific material or component. Each material or component is listed with its service life, or period of time after installation it is expected to meet the service requirements prior to replacement or repair. This value is indicated in parentheses next to the mass of the material associated with the listed Revit family. Values for transportation distance or service life shown with an asterisk (*) indicate user-defined changes to default values. Values for service life shown with a dagger (†) indicate materials identified by the modeler as existing or salvaged.

CLT, KLH Massivholz, KLH Solid Timber Panels, 320 mm - EPD **145,939.1 kg**

Used in the following Revit families:

175 CLT	93,506.3 kg (60 yrs)
87 CLT	52,432.9 kg (60 yrs)

Used in the following Tally entries:
- Cross laminated timber (CLT)

Description:
Solid cross-laminated timber boards by KLH. Appropriate for load-bearing, reinforced and non-load-bearing walls, ceilings and roofing elements. 320 mm thickness. EPD representative of Austrian (AT) conditions.

Life Cycle Inventory:
For information and quantities, see EPD

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 468 km

End-of-Life Scope:
14.5% Recovered
22% Incinerated with energy recovery
63.5% Landfilled (wood product waste)

Module D Scope:
Recovered wood products credited as avoided burden. Includes credits for recovered energy during manufacturing

LCI Source:
AT: KLH A1-A3 - 320 mm PE-EPD (2012)
AT: KLH D - 320 mm PE-EPD (2012)

EPD Source:
EPD-KLH-2012111-E

EPD Designation Holder:
KLH Massivholz GmbH

EPD Program Operator:
Institut Bauen und Umwelt (IBU)

EPD Expiration:
1/31/2017

Coated steel deck, SDI - EPD **1,281,432.8 kg**

Used in the following Revit families:

75 TOPPING ON 203 HOLLOWCORE SLAB	271,875.0 kg (60 yrs)
900 DP DOUBLE TEE PC BEAMS + 75MM TOPPING	1,009,557.7 kg (60 yrs)

Used in the following Tally entries:
- Steel, deck

Description:
Coated steel roof and floor deck panels, 1 ½" – 3" in depth and manufactured from 22 – 16 gage material. Industry-wide EPD from the Steel Deck Institute.

LCI Data (continued)

Life Cycle Inventory:
For information and quantities, see EPD

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 431 km

End-of-Life Scope:
98% Recovered
2% Landfilled (inert material)

Module D Scope:
Product has 28% scrap input while remainder is processed and credited as avoided burden.

LCI Source:
US: Steel deck - Steel deck institute (SDI) (A1-A3) ts (2012)

EPD Source:
4786052957.101.1

EPD Designation Holder:
Steel Deck Institute

EPD Program Operator:
UL Environment

EPD Expiration:
12/15/2020

Concrete masonry unit (CMU), hollow-core **566.5 kg**

Used in the following Revit families:

MASONRY - 190	566.5 kg (60 yrs)

Used in the following Tally entries:
Hollow-core CMU

Description:
Hollow-Core Concrete Masonry Unit (CMU), excludes grout and mortar

Life Cycle Inventory:
100% Concrete masonry units

Product Scope:
Cradle to gate, excludes mortar
Anchors, ties, and metal accessories outside of scope (<1% mass)

Transportation Distance:
By truck: 172 km

End-of-Life Scope:
55% Recycled into coarse aggregate
45% Landfilled (inert material)

Module D Scope:
Avoided burden credit for coarse aggregate, includes grinding energy

LCI Source:
DE: Concrete bricks (EN15804 A1-A3) ts (2017)

Epoxy coating, metal stock **20,960.1 kg**

Used in the following Revit families:

CISC HSS Rectangular(CSA G40.21)	2,513.3 kg (60 yrs*)
CISC Wide Flange Shapes	18,446.8 kg (60 yrs*)

Used in the following Tally entries:
Steel, rectangular tubing
Steel, W section (wide flange shape)

Description:
Epoxy coating, for metal stock

Life Cycle Inventory:
100% Epoxy coating

Product Scope:
Cradle to gate, includes application

Transportation Distance:
N/A

End-of-Life Scope:
100% Landfilled (inert waste)

LCI Source:
DE: Application base coat (automobile) ts (2017)
DE: Epoxy Resin (EP) mix ts (2017)

Fireproofing, intumescent paint **140,281.1 kg**

Used in the following Revit families:

75 TOPPING ON 203 HOLLOWCORE SLAB	29,762.7 kg (60 yrs)
900 DP DOUBLE TEE PC BEAMS + 75MM TOPPING	110,518.4 kg (60 yrs)

Used in the following Tally entries:
Steel, deck

Description:
Intumescent fireproof coating, for use on exposed structural steel. Default application rate assumes a thickness of 45 mils.

Life Cycle Inventory:
20% Titanium dioxide
5% Silica
10% Triamino triazine
10% Pentaerythritol
2% Amino methyl propanol
Less than 0.3% VOC emission

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 642 km

End-of-Life Scope:
100% Landfilled (inert waste)

LCI Source:
US: Electricity grid mix ts (2014)
DE: Polyethylene glycol (PEG) ts (2017)
US: Triethanolamine (TEA) ts (2017)
US: Titanium dioxide pigment ts (2017)
US: Silica sand (flour) ts (2017)
DE: Melamine ts (2017)
US: Tap water from groundwater ts (2017)

Fireproofing, intumescent paint, by area **35,140.9 kg**

Used in the following Revit families:

CISC Wide Flange Shapes	35,140.9 kg (60 yrs)

Used in the following Tally entries:
Steel, W section (wide flange shape)

Description:
Intumescent fireproof coating, for use on exposed structural steel.

Life Cycle Inventory:
20% Titanium dioxide
5% Silica
10% Triamino triazine
10% Pentaerythritol
2% Amino methyl propanol
Less than 0.3% VOC emission

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 642 km

End-of-Life Scope:
100% Landfilled (inert waste)

LCI Source:
US: Electricity grid mix ts (2014)
DE: Polyethylene glycol (PEG) ts (2017)
US: Triethanolamine (TEA) ts (2017)
US: Titanium dioxide pigment ts (2017)
US: Silica sand (flour) ts (2017)
DE: Melamine ts (2017)
US: Tap water from groundwater ts (2017)

LCI Data (continued)

Galvanized steel **3,678,397.2 kg**

Used in the following Revit families:
- CISC HSS Rectangular(CSA G40.21) 1,288,853.3 kg (60 yrs*)
- CISC Wide Flange Shapes 2,389,543.9 kg (60 yrs*)

Used in the following Tally entries:
- Steel, rectangular tubing
- Steel, W section (wide flange shape)

Description:
Hot dipped galvanized steel profile, for use with cladding systems.

Life Cycle Inventory:
100% Steel, hot dip galvanized

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 431 km

End-of-Life Scope:
98% Recovered
2% Landfilled (inert material)

Module D Scope:
Product has 44% scrap input while remainder is processed and credited as avoided burden

LCI Source:
RNA: Steel hot dip galvanized worldsteel (2007)
GLO: Steel sheet stamping and bending (5% loss) ts (2014)
US: Electricity grid mix ts (2014)
US: Lubricants at refinery ts (2014)
GLO: Compressed air 7 bar (medium power consumption) ts (2014)
US: Metal roll forming M CA (2010)
GLO: Value of scrap worldsteel (2014)

Glue laminated timber (Glulam), AWC - EPD **105,103.2 kg**

Used in the following Revit families:
- LEA_Timber_Sawn Column 31,541.1 kg (60 yrs*)
- LEA_Timber_Solid Beam 73,562.1 kg (60 yrs)

Used in the following Tally entries:
- Glue laminated timber (Glulam)

Description:
Architectural grade structural glue-laminated timber (Glulam), an engineered wood product manufactured from end-joined, laminated, and planed lumber pressure-treated with resins. Typically used for beams, headers, columns, and arches. Entry inclusive of factory applied sealer. Industry-wide EPD from the American Wood Council.

Life Cycle Inventory:
For information and quantities, see EPD

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 468 km

End-of-Life Scope:
14.5% Recovered
22% Incinerated with energy recovery
63.5% Landfilled (wood product waste)

Module D Scope:
Recovered wood products credited as avoided burden.

LCI Source:
RNA: Glue laminated timbers CORRIM (2011)

EPD Source:
13CA24184.104.1

EPD Designation Holder:
American Wood Council and Canadian Wood Council

EPD Program Operator:
UL Environment

EPD Expiration:
4/16/2019

Mortar type S **74.7 kg**

Used in the following Revit families:
- MASONRY - 190 74.7 kg (60 yrs)

Used in the following Tally entries:
- Hollow-core CMU

Description:
Mortar Type S (medium strength mortar) for use with masonry walls and flooring.

Life Cycle Inventory:
Dried mix: 78% sand
17% cement
4% calcium hydroxide
1% limestone (12% water evaporates on drying)

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 172 km

End-of-Life Scope:
55% Recycled into coarse aggregate
45% Landfilled (inert material)

Module D Scope:
Avoided burden credit for coarse aggregate, includes grinding energy

LCI Source:
DE: Siliceous sand (grain size 0/2) ts (2017)
DE: Cement (CEM I 32.5) (EN15804 A1-A3) ts (2017)
DE: Gravel (Grain size 2/32) (EN15804 A1-A3) ts (2017)
US: Tap water from groundwater ts (2017)

Paint, enamel, solvent based **88,317.3 kg**

Used in the following Revit families:
- 900 DP DOUBLE TEE PC BEAMS + 75MM TOPPING 88,317.3 kg (15 yrs)

Used in the following Tally entries:
- Steel, deck

Description:
Solvent-based enamel paint, appropriate for use on metals

Life Cycle Inventory:
17% Binding agent
16% Pigments and fillers
67% Solvent

Product Scope:
Cradle to gate, including emissions during application

Transportation Distance:
By truck: 642 km

End-of-Life Scope:
33% Solids landfilled (plastic waste)

LCI Source:
DE: Solvent paint white (EN15804 A1-A3) ts (2017)

Paint, exterior acrylic latex **4.7 kg**

Used in the following Revit families:
- MASONRY - 190 4.7 kg (10 yrs)

Used in the following Tally entries:
- Hollow-core CMU

Description:
Acrylic-based latex paint for exterior applications. Associated reference table includes primer.

Life Cycle Inventory:
20.5% Binding agent
35% Pigments and fillers
40% Water
4.5% Organic solvents

Product Scope:
Cradle to gate, including emissions during application

Transportation Distance:
By truck: 642 km

LCI Data (continued)

End-of-Life Scope:
100% to landfill (plastic waste)

LCI Source:
DE: Application paint emulsion (building, exterior, white) ts (2017)

Paint, exterior metal coating, silicone-based **6,110.0 kg**

Used in the following Revit families:

75 TOPPING ON 203 HOLLOWCORE SLAB	6,110.0 kg (30 yrs)

Used in the following Tally entries:
Steel, deck

Description:
Silicone-based metal paint, with a default coating thickness of 100 microns

Life Cycle Inventory:
23% Binding agent
35% Pigments and fillers
40% Water
1.5% Organic solvents

Product Scope:
Cradle to gate, including emissions during application

Transportation Distance:
By truck: 642 km

End-of-Life Scope:
100% to landfill (plastic waste)

LCI Source:
DE: Application coating silicone (building, exterior, white) ts (2017)

Steel, concrete reinforcing steel, CMC - EPD **8,629,852.7 kg**

Used in the following Revit families:

150 CONCRETE S.O.G. (SOG1)	426,905.7 kg (60 yrs)
1500 DP MAT FOOTING	2,767,245.4 kg (60 yrs)
180 CONCRETE SLAB	143.5 kg (60 yrs)
200 CONCRETE SLAB	14,071.5 kg (60 yrs)
200 CONCRETE SLAB + 75 TOPPING	18,270.3 kg (60 yrs)
200 CONCRETE SLAB CAST-IN-PLACE	7,175.2 kg (60 yrs)
250 CONCRETE SLAB	650.6 kg (60 yrs)
300 CONCRETE SLAB	7,818.6 kg (60 yrs)
350 CONCRETE SLAB	10,511.4 kg (60 yrs)
500 CONCRETE SLAB	65,718.7 kg (60 yrs)
75 TOPPING ON 203 HOLLOWCORE SLAB	136,552.6 kg (60 yrs)
750 DP MAT FOOTING	28,816.8 kg (60 yrs)
900 DP DOUBLE TEE PC BEAMS + 75MM TOPPING	4,294,617.5 kg (60 yrs)
CORBEL BEAM	36,762.3 kg (60 yrs)
LEA_Concrete-Column	275,349.3 kg (60 yrs)
LEA_Concrete-Rectangular Beam	27,470.5 kg (60 yrs)
LEA_Concrete-Round-Column	17,461.2 kg (60 yrs)
LEA_Footing-Rectangular	301,975.6 kg (60 yrs)
LEA_Precast Girder Beam for Double Tee	76,215.3 kg (60 yrs)
LEA_Precast Girder Beam for Double Tee (Single Ledge)	19,253.3 kg (60 yrs)
SF1 - 1500x750 DP.	31,449.6 kg (60 yrs)
SF2 - 200 x 200 (RETAINING)	8,449.5 kg (60 yrs)
SF3 - 1400 x 1000 (RETAINING)	56,968.2 kg (60 yrs)

Used in the following Tally entries:
Cast-in-place concrete, structural concrete, 5000 psi
Precast concrete column
Precast concrete double-tee
Precast concrete inverted-tee

Description:
Concrete reinforcing steel (rebar) by Commercial Metals Company. Appropriate for use as reinforcement in concrete. EPD representative of conditions in the US.

Life Cycle Inventory:
For information and quantities, see EPD

Product Scope:
Cradle-to-gate

Transportation Distance:
By truck: 431 km

End-of-Life Scope:
98% Recovered
2% Landfilled (inert material)

Module D Scope:
Product has 100% scrap input, burden reflects difference between recovered material and scrap input. Credit given for the avoided burden associated with recovered material.

LCI Source:
EPD (US), Commercial Metals Company (2015)

EPD Source:
EPD-012

EPD Designation Holder:
Commercial Metals Company (CMC)

EPD Program Operator:
ASTM International

EPD Expiration:
9/1/2020

Steel, reinforcing rod **2,058.3 kg**

Used in the following Revit families:

LEA_Footing-Rectangular	85.5 kg (60 yrs)
LEA_Rod	1,972.7 kg (60 yrs)

Used in the following Tally entries:
Precast concrete inverted-tee
Steel, rod

Description:
Common unfinished tempered steel rod suitable for structural reinforcement (rebar)

Life Cycle Inventory:
100% Steel rebar

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 431 km

End-of-Life Scope:
70% Recovered
30% Landfilled (inert material)

Module D Scope:
Product has a 16.4% scrap input while remainder is processed and credited as avoided burden.

LCI Source:
GLO: Steel rebar worldsteel (2014)

Steel, welded wire mesh **103,638.7 kg**

Used in the following Revit families:

200 CONCRETE SLAB + 75 TOPPING	12,070.5 kg (60 yrs)
75 TOPPING ON 203 HOLLOWCORE SLAB	91,568.2 kg (60 yrs)

Used in the following Tally entries:
Precast concrete slab

Description:
Steel rods further processed into wires appropriate for welded wire mesh reinforcement

Life Cycle Inventory:
100% Carbon steel wire

Product Scope:
Cradle to gate

Transportation Distance:
By truck: 431 km

End-of-Life Scope:
98% Recovered
2% Landfilled (inert material)

Module D Scope:
Product has 16% scrap input while remainder is processed and credited as avoided burden

LCI Source:
GLO: Steel wire rod worldsteel (2014)
DE: Copper wire (0.6 mm) ts (2017)
US: Electricity grid mix ts (2014)
US: Thermal energy from natural gas ts (2014)

LCI Data (continued)

Structural concrete, 4000 psi, 20% fly ash and 30% slag **14,033,132.8 kg**

Used in the following Revit families:

300 THK PC	40,759.7 kg (60 yrs)
400 THK PC	5,949,470.8 kg (60 yrs)
500 THK PC	1,298,648.7 kg (60 yrs)
600 THK PC	1,763,733.5 kg (60 yrs)
CONCRETE - 250	228,561.5 kg (60 yrs)
CONCRETE - 300	4,654,578.3 kg (60 yrs)
CONCRETE - 660	97,380.3 kg (60 yrs)

Used in the following Tally entries:
Cast-in-place concrete, structural concrete, 4000 psi

Description:
Structural concrete, 4000 psi, 20% fly ash and 30% slag. Mix design matches National Ready-Mix Concrete Association (NRMCA) Industry-wide EPD.

Life Cycle Inventory:
Coarse aggregate: 45%, Sand: 31%, Portland cement PCA - EPD: 9%, Water: 7%, Expanded slag: 5%, Fly ash: 3%, Admixture: <1%

Product Scope:
Cradle to gate
Anchors, ties, and metal accessories outside of scope (<1% mass)

Transportation Distance:
By truck: 24 km

End-of-Life Scope:
55% Recycled into coarse aggregate
45% Landfilled (inert material)

Module D Scope:
Avoided burden credit for coarse aggregate, includes grinding energy

LCI Source:
US: Portland cement PCA/ts (2014)
DE: Pumice gravel (grain size 4/16) (EN15804 A1-A3) ts (2017)
DE: Gravel (Grain size 2/32) (EN15804 A1-A3) s (2017)
DE: Fly ash (EN15804 A1-A3) ts (2017)
DE: Slag-tap granulate (EN15804 A1-A3) ts (2017)
DE: Expanded clay (EN15804 A1-A3) ts (2017)
DE: alcium nitrate ts (2017)
DE: Sodium ligninsulfonate ts (2017)
DE: Sodium naphtalene sulfonate [estimated] ts (2017)
US: Sodium hydroxide (caustic soda) ix (100%) ts (2017)
US: Colophony (rosin, refined) from CN pine gum rosin ts (2017)
US: Tap water from groundwater ts (2017)
US: Electricity grid mix s (2014)
US: Natural gas mix ts (2014)
US: Diesel mix at filling station (100% fossil) ts (2014)
US: Liquefied Petroleum Gas (LPG) (70% propane 30% utane) ts (2014)
US: Light fuel oil at refinery ts (2014)

Structural concrete, 5000 psi, 0% fly ash and slag **5,908.9 kg**

Used in the following Revit families:

LEA_Footing-Rectangular	5,908.9 kg (60 yrs)

Used in the following Tally entries:
Precast concrete inverted-tee

Description:
Structural concrete, 5000 psi, 0% fly ash and slag. Mix design matches National Ready-Mix Concrete Association (NRMCA) Industry-wide EPD.

Life Cycle Inventory:
Coarse aggregate: 40%, Sand: 33%, Portland cement PCA - EPD: 20%, Water: 7%, Admixture: <1%

Product Scope:
Cradle to gate
Anchors, ties, and metal accessories outside of scope (<1% mass)

Transportation Distance:
By truck: 24 km

End-of-Life Scope:
55% Recycled into coarse aggregate
45% Landfilled (inert material)

Module D Scope:
Avoided burden credit for coarse aggregate, includes grinding energy

LCI Source:
US: Portland cement PCA/ts (2014)
DE: Pumice gravel (grain size 4/16) (EN15804 A1-A3) ts (2017)
DE: Gravel (Grain size 2/32) (EN15804 A1-A3) s (2017)
DE: Fly ash (EN15804 A1-A3) ts (2017)
DE: Slag-tap granulate (EN15804 A1-A3) ts (2017)
DE: Expanded clay (EN15804 A1-A3) ts (2017)
DE: alcium nitrate ts (2017)
DE: Sodium ligninsulfonate ts (2017)
DE: Sodium naphtalene sulfonate [estimated] ts (2017)
US: Sodium hydroxide (caustic soda) ix (100%) ts (2017)
US: Colophony (rosin, refined) from CN pine gum rosin ts (2017)
US: Tap water from groundwater ts (2017)
US: Electricity grid mix s (2014)
US: Natural gas mix ts (2014)
US: Diesel mix at filling station (100% fossil) ts (2014)
US: Liquefied Petroleum Gas (LPG) (70% propane 30% utane) ts (2014)
US: Light fuel oil at refinery ts (2014)

Structural concrete, 5000 psi, 20% fly ash and 30% slag **229,525,105.3 kg**

Used in the following Revit families:

150 CONCRETE S.O.G. (SOG1)	10,663,559.2 kg (60 yrs)
1500 DP MAT FOOTING	21,960,845.8 kg (60 yrs)
180 CONCRETE SLAB	3,583.8 kg (60 yrs)
200 CONCRETE SLAB	351,488.8 kg (60 yrs)
200 CONCRETE SLAB + 75 TOPPING	1,673,354.2 kg (60 yrs)
200 CONCRETE SLAB CAST-IN-PLACE	179,227.9 kg (60 yrs)
250 CONCRETE SLAB	16,250.3 kg (60 yrs)
300 CONCRETE SLAB	195,298.1 kg (60 yrs)
350 CONCRETE SLAB	262,562.2 kg (60 yrs)
500 CONCRETE SLAB	1,641,568.3 kg (60 yrs)
75 TOPPING ON 203 HOLLOWCORE SLAB	12,643,107.3 kg (60 yrs)
750 DP MAT FOOTING	228,690.2 kg (60 yrs)
900 DP DOUBLE TEE PC BEAMS + 75MM TOPPING	164,655,203.8 kg (60 yrs)
CORBEL BEAM	291,745.8 kg (60 yrs)
LEA_Concrete-Column	3,473,871.2 kg (60 yrs)
LEA_Concrete-Rectangular Beam	218,006.1 kg (60 yrs)
LEA_Concrete-Round-Column	138,571.9 kg (60 yrs)
LEA_Footing-Rectangular	2,396,476.9 kg (60 yrs)
LEA_Precast Girder Beam for Double Tee	5,122,848.9 kg (60 yrs)
LEA_Precast Girder Beam for Double Tee (Single Ledge)	1,525,208.6 kg (60 yrs)
SF1 - 1500x750 DP.	249,584.0 kg (60 yrs)
SF2 - 200 x 200 (RETAINING)	211,058.7 kg (60 yrs)
SF3 - 1400 x 1000 (RETAINING)	1,422,993.3 kg (60 yrs)

Used in the following Tally entries:
Cast-in-place concrete, structural concrete, 5000 psi
Precast concrete column
Precast concrete double-tee
Precast concrete inverted-tee
Precast concrete slab

Description:
Structural concrete, 5000 psi, 20% fly ash and 30% slag. Mix design matches National Ready-Mix Concrete Association (NRMCA) Industry-wide EPD.

Life Cycle Inventory:
Coarse aggregate: 41%, Sand: 30%, Portland cement PCA - EPD: 11%, Water: 7%, Expanded slag: 6%, Fly ash: 4%, Admixture: <1%

Product Scope:
Cradle to gate
Anchors, ties, and metal accessories outside of scope (<1% mass)

Transportation Distance:
By truck: 24 km

End-of-Life Scope:
55% Recycled into coarse aggregate
45% Landfilled (inert material)

Module D Scope:
Avoided burden credit for coarse aggregate, includes grinding energy

LCI Source:
US: Portland cement PCA/ts (2014)
DE: Pumice gravel (grain size 4/16) (EN15804 A1-A3) ts (2017)
DE: Gravel (Grain size 2/32) (EN15804 A1-A3) s (2017)
DE: Fly ash (EN15804 A1-A3) ts (2017)

LCI Data (continued)

DE: Slag-tap granulate (EN15804 A1-A3) ts (2017)
DE: Expanded clay (EN15804 A1-A3) ts (2017)
DE: alcium nitrate ts (2017)
DE: Sodium ligninsulfonate ts (2017)
DE: Sodium naphtalene sulfonate [estimated] ts (2017)
US: Sodium hydroxide (caustic soda) ix (100%) ts (2017)
US: Colophony (rosin, refined) from CN pine gum rosin ts (2017)
US: Tap water from groundwater ts (2017)
US: Electricity grid mix s (2014)
US: Natural gas mix ts (2014)
US: Diesel mix at filling station (100% fossil) ts (2014)
US: Liquefied Petroleum Gas (LPG) (70% propane
30% utane) ts (2014)
US: Light fuel oil at refinery ts (2014)

Thickset mortar **611.7 kg**

Used in the following Revit families:

MASONRY - 190	611.7 kg (60 yrs)

Used in the following Tally entries:
Hollow-core CMU

Description:
Grout, for masonry

Life Cycle Inventory:
15% Cement
50% Sand
21% Gravel
14% Water

Product Scope:
Cradle to gate, excludes mortar
Anchors, ties, and metal accessories outside of scope (<1% mass)

Transportation Distance:
By truck: 172 km

End-of-Life Scope:
55% Recycled into coarse aggregate
45% Landfilled (inert material)

Module D Scope:
Avoided burden credit for coarse aggregate, includes grinding energy

LCI Source:
US: Portland cement PCA/ts (2014)
US: Tap water from groundwater ts (2017)
EU-28: Gravel 2/32 ts (2017)
US: Silica sand (Excavation and processing) ts (2017)

Wood stain, water based **1,714.4 kg**

Used in the following Revit families:

175 CLT	122.8 kg (60 yrs*)
87 CLT	138.6 kg (60 yrs*)
LEA_Timber_Sawn Column	433.3 kg (10 yrs)
LEA_Timber_Solid Beam	1,019.7 kg (10 yrs)

Used in the following Tally entries:
Cross laminated timber (CLT)
Glue laminated timber (Glulam)

Description:
Semi-transparent stain for interior and exterior wood surfaces

Life Cycle Inventory:
60% Water
28% Acrylate resin
7% Acrylate emulsion
5% Dipropylene glycol
1.3% NMVOC emissions

Product Scope:
Cradle to gate, including emissions during application

Transportation Distance:
By truck: 642 km

End-of-Life Scope:
38.7% solids to landfill (plastic waste)

LCI Source:
US: Tap water from groundwater ts (2017)
US: Acrylate resin (solvent-systems) ts (2017)
DE: Acrylate (emulsion) ts (2017)
US: Dipropylene glycol by product propylene glycol via PO hydrogenation ts (2017)

APPENDIX C: REVIEW OF CUMULATIVE EFFECTS

New Civic Development Phase 2 Project: Parking Garage and Green Roof

Review of Cumulative Effects

June 2022

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1.0 Introduction and Background

Cumulative effects are residual effects on the environment combined with the environmental effects of past, present and future projects or activities. Cumulative effects can also result from the combination of different individual environmental effects of the project, acting on the same environmental component.

At the Master Site Plan Stage, a number of studies were prepared to identify possible environmental contstaints and identify potential impacts to be studied as detailed phases were brought forth for approval. These included:

- Environmental Impact Statement and Tree Conservation Report – Master Site Plan
- Transportation Impact Statement and Assessment and Mobility Study
- Cultural Heritage Impact Statement
- Phase I Environmental Site Assessment
- Pedestrian Level Wind Study
- Environmental Noise and Vibration Assessment
- Geotechnical Review
- Master Servicing Report

The detailed Environmental Effects Analysis/Environmental Impact Statement and Tree Conservation Report Update was prepared to review the Phase 2 Project and identified required mitigation measures to avoid or reduce potential envrionmental effects of the project. The report also identified residual effects. As an update, this section reviews the potential cummulative effects of projects on or connected to the new Civic development.

A general framework for Cumulative Effects Analysis includes the following tasks:

- Scoping
- Analysis of Effects
- Identification of Mitigation Measures
- Evaluation of Significance
- Follow-up/Monitoring

2.0 Project and Environmental Component Scoping

Scoping involves the identification of projects, key issues of concern / valued components (VCs), thereby ensuring that the assessment remains focused, and the analysis remains practical. In order to consider the potential cumulative environmental effects of the project, spatial and temporal boundaries must be determined.

2.1 New Civic Development and Connected Projects

Spatially, this assessment has identified other past, present, or foreseeable future projects and activities that have been or will be carried out within (or connected to) the new Civic development (NCD), that will occur over the NCD development period. Error! Reference source not found. below identifies each phase of the NCD project, it's associated duration and phase description. Additional separate projects within the NCD site have also been considered. It is important to note that while the dates of each phase of the project have been identified, they are meant to be dates of implementation. Some project works for a specific phase may occur in conjunction with other project phases and their cumulative effects will be reviewed at each subsequent phase of development.

Table 1: New Civic Development Implementation

Phase/Project/Planned Completion Date	Component	Description
Separate project occurring on NCD site (Complete 2022)	Demolition and remediation of the Sir John Carling building and West Annex site.	The West Annex has been vacant since 2009. In 2016, the site was selected as the location of the future NCD. It was determined that it is not desirable to integrate the West Annex into the new hospital development. Demolition of the West Annex building, and associated site remediation of the former Sir John Carling Building will be complete in 2022.
Separate project occurring on NCD site (2023-2024)	Existing site servicing relocations and abandonment.	In order to accommodate the proposed hospital building and central utility plant within the site, existing private infrastructure (including but not limited to sanitary sewers, storm sewers, and watermains) will need to be relocated to ensure services are maintained to the existing buildings and lands located immediately to the west of the new hospital site. Any private infrastructure that is no longer required will be abandoned.
Widening of LRT Trench (Timing dependent on City of Ottawa)	Future widening of the LRT trench north and south of the Phase 2 boundary and replacement of Prince of Wales Bridge.	The first phase of implementation is anticipated to include widening of the Trillium LRT trench to accommodate a second LRT track that would be constructed in the future. Note that the construction associated with the trench is separate from the NCD construction. Twinning of the LRT trench outside the NCD boundary is dependent on the City of Ottawa.
Phase 2 (2022-2024)	Parking Garage and Green Roof. **Basis for Cumulative Effects Analysis. Residual effects identified for VCs of this Phase.**	The parking garage is planned to have approximately 2,500 parking spaces and additional bike parking capacity. It will include a green roof which will detain storm water run-off and mitigate the heat island effect. It will also provide parking for nearby commercial and retail services and reserve 200 public parking spaces for NCC activities associated with Commissioners Park, the Arboretum, Dow's Lake and seasonal festivals. The parking garage is planned to open in 2024, in part to provide contractor parking for construction workers on the Central Utility Plant and main Hospital building project.
Phase 3 (2024-2026)	Central Utility Plant (CUP).	Development of the CUP will be undertaken in the early stages of the hospital's physical development in order to aid in the site's construction activities. The CUP will house NCD's critical utility infrastructure required for the operation of the NCD. The CUP will be located adjacent to the main hospital and has been designed and sited (sunken into the landscape) to minimize its visual impact and vertical encroachment on the adjacent Central Experimental Farm.
Phase 4 (2024-2026)	Main Hospital Building.	The main Hospital building includes approximately 2.5 million square feet of space to accommodate the tertiary trauma facility as a replacement for the existing Civic Campus. It will include outpatient, inpatient, diagnostic and treatment facilities as well as the integration of research and education.

Phase/Project/Planned Completion Date	Component	Description
Phase 5 (TBD)	Dow's Lake LRT Station Entrance.	The Dow's Lake Station south access is located east of Tower A. This building is expected to accommodate access to the existing north LRT station from a pedestrian tunnel under or over Carling Avenue (which will be the subject of a City of Ottawa Class Environmental Assessment Process, access at grade as well as access through to the enclosed pedestrian connection (highline) over the Parking Garage to the Hospital.
Phase 6 (2024-2029)	Research Tower.	The research tower is designed to be adjacent to the North Tower of the Hospital and will have an overhead connection to both the North Tower and the Parking Garage (via an extension of the highline). It will serve as a point at the entrance of the site at Carling and Champagne Avenues.
Phase 7 (2029-2039)	Carling Village Towers	Tower A is anticipated to be a mid- rise building that will frame the eastern edge of the main entrance to the Site to the west of the proposed Dow's Lake Station south access. This tower will include retail and accommodate overnight visitors and families to the hospital facing Carling Avenue as well as the main entrance access to the Hospital (Road A) complementing and activating the urban street edge.
		Tower B located east of the LRT station entrance, will be built to align with a service road along the south, adjacent to the Parking Garage. The building will include a podium that will act to diminish the scale along Carling through both setbacks and potential minor cantilevers for balanced massing. The podium roof will also align with the Rooftop Park of the Parking Garage to allow for potential access to the south.
		Tower C is located at the southwestern corner of Carling Avenue and Preston Street. The opportunity to create a nationally significant building on NCC land is being explored through the development of The Ottawa Hospital Innovation Center. The Innovation Center planned for Tower C includes structural and sustainable approaches exploring groundbreaking strategies that can promote new ways of building.
Phase 8 (2024-2028)	Rehabilitation Tower.	The north tower structure will be designed to include the future expansion. Space for mechanical and electrical infrastructure for the future floors is being included in the initial phase on the primary service level (Level 4) as well as space for future vertical shafts/services/knockout panels in the concrete slabs of the initial phase. Main elevators and vertical circulation are sized from inception to accommodate the loading and logistics of future floors on the north tower
Phase 9 (2035-2038)	Main Hospital Building Expansion.	
Phase 10 (2045-2048)	Heart Institute.	The relocation of the University of Ottawa Heart Institute to the site is anticipated as the last phase of the NCD development. The Heart Institute location was chosen due to operational requirements with the main Hospital building. .

2.2 Identified Valued Components and Associated Residual Effects Phase 2 Parking Garage

Numerous valued components have been identified during the preparation of the s.82 Environmental Effects Analysis for the Phase 2 Parking Garage project. Following a detailed impact analysis, it has been determined that residual impacts will impact few VCs following the implementation of appropriate mitigation measures. The VCs where residual effects have been identified for construction (Table 2) and operation (Table 3) have been carried forward for inclusion in this review of Cumulative Effects.

Table 2: Project Level Valued Components Interactions (Construction)

Project Valued Component		Identified Parking Garage Residual Effect	Indicator/ Interactions
Decarbonization	Greenhouse Gases	None identified for construction phase of the project.	None identified.
Vegetation	Trees	Temporary loss of vegetation will occur during construction. Potential for impact to vegetation not intended for removal.	Loss of vegetation from projects occurring within the same/overlapping timeframe and or, past or future projects occurring within or immediately adjacent the NCD site boundary.
Wildlife and Associated Habitat	General Habitat	Temporary loss of general habitat during construction.	Reduction in species presence from the area from projects occurring within the same/overlapping time frame and or, past or future projects occurring within or immediately adjacent the NCD site boundary.
	Migratory Birds	Temporary loss of migratory bird nesting habitat as a result of tree and vegetation removals during construction.	Loss of migratory bird nesting habitat and the reduction in species presence from projects occurring within the same/overlapping time frame and or, past or future projects occurring within or immediately adjacent the NCD site boundary.
	Bats	Temporary loss of potential bat roosting habitat as a result of the removal of large diameter trees during construction.	Loss of potential bat roosting habitat and the reduction in species presence from projects occurring within the same/overlapping time frame and or, past or future projects occurring within or immediately adjacent the NCD site boundary.
	Raptors (Coopers Hawk)	No residual effects have been identified during construction.	None Identified.
Species at Risk Species at Risk	Monarch	Temporary loss of vegetation suitable for Monarch foraging and breeding as a result of construction.	Loss of vegetation suitable for Monarch foraging and breeding and the reduction in species presence from projects occurring within the same/overlapping time frame and or, past or future projects occurring within or immediately adjacent the NCD site boundary.
	Yellow-Banded Bumble Bee	Impact to potential, Yellow-banded bumble bee nests or over wintering habitat as a result of works occurring in suitable habitats.	Impact to potential, Yellow-banded bumble bee nests or over wintering habitat from projects occurring within the same/overlapping time frame and or, past or future projects occurring within or immediately adjacent the NCD site boundary.

Project Valued Component		Identified Parking Garage Residual Effect	Indicator/ Interactions
Sensitive Receivers	Noise and other sensory disturbances	Noise from construction may be a temporary disturbance	Noise and other sensory disturbances from projects occurring within the same/overlapping time frame and or, past or future projects occurring within or immediately adjacent the NCD site boundary.
Land Use and Recreation	Disruptions to Roadway Users	Disruptions to roadway users as a result of construction activities	Inconvenience to roadway users from projects occurring within the same/overlapping time frame and or future projects occurring within or immediately adjacent the NCD site boundary.

Table 3: Project Level Valued Components Interactions (Operation)

Project Valued Component (VC)		Identified Parking Garage Residual Effect	Indicator/ Interactions
Decarbonization	Greenhouse Gasses	Decarbonization, TDM and provision of Active Transportation Facilities will result in a positive contribution to limit greenhouse gas emissions.	Reduction in greenhouse gas emissions.
Vegetation	Trees	Intensive replanting and the increase in canopy cover.	Significant increase in the sites canopy cover.
Wildlife and Associated Habitat	General Habitat	Intensive replanting and the increase in canopy cover.	Overall increase in site habitat. Presence of wildlife.
		Implementation of lighting principles and the reduction of impacts to light sensitive wildlife as of result of artificial lighting.	Reduced impacts to light sensitive wildlife.
	Migratory Birds	Intensive replanting and the increase in canopy cover.	Increase in migratory bird habitat. Increase in the presence migratory birds at the site.
		Potential bird strikes with glazed surfaces (and reflective) and entrapments associated with other design elements.	Reduction of bird strikes and entrapments as a result of building and facility design elements.
	Bats	Intensive replanting and the increase in canopy cover.	Significant increase in the sites canopy cover, presence of bats and habitat.
	Raptors (Coopers Hawk)	No residual effects have been identified during operation.	Coopers Hawk presence to remain at the NCD site.
Species at Risk	Monarch	Pollinator focused planting to enhance habitat for this species.	Enhanced Monarch habitat. Presence of Monarch.
Species at Risk	Yellow-Banded Bumble Bee	Pollinator focused planting to enhance habitat for this species.	Enhanced, Yellow-banded bumble bee habitat. Presence of Yellow-banded bumble bee.
Land Use and Recreation	Recreation, Greenspace and Aesthetics	Opportunities for recreation, landscaping and enhanced views.	Implementation of recreational features, improved landscaping and enhanced views.
	Pedestrian and cycling facilities	Enhanced pedestrian and cycling crossings at new and modified intersections.	Enhanced pedestrian experience and user safety.
Plans and Policies	Master Site Plan	Consistent with Plans and Policies.	Implementation in accordance with approved Master Site Plan.
Shadows	Shadows	Shadows to occur infrequently over a short period of time each year.	Presence of shadows.

A description and a checklist identifying the potential for interaction with the identified regional valued components and associated projects are identified in Table 4. While the Phase 2 Parking Garage project is expected to be complete long before full build out of the site, potential valued component interactions spatially and temporally still may occur over this period. Potential interactions have been identified with Yes or No, along within the residual effect associated with the project phase, identified either as construction (C) or operation (O). The impact of the residual effect has been identified as either positive (+) or negative (-).

Table 4: Potential Interactions with the Identified Valued Components

Project	Decarbonization	Vegetation	Wildlife and Associated Habitat				Species at Risk		Sensitive Receivers	Land Use and Recreation		Plans & Policies	Shadows
	Greenhouse Gas Emissions	Trees	General Habitat	Migratory Birds	Bats	Raptors (Coopers Hawk)	Monarch	Yellow banded Bumble Bee	Noise & Other Sensory Disturbances	Recreation, Greenspace & Aesthetics	Pedestrian & Cycling Facilities	Master Site Plan	Shadows
Demolition and Remediation of the Sir John Carling Building	No	Yes (C)(-)	No	No	No	No	No	No	No	No	No	No	No
Existing Site Servicing Relocation and Abandonment	No	Yes (C)(-)	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	No	No	No	Yes (C)(-)	No	No	Yes (O)(+)	No
Phase 3: Central Utility Plant (2024-2026)	Yes (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	No	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-)	Yes (O)(+)	No	Yes (O)(+)	No
Phase 4: Main Hospital Building (2024-2028)	Yes (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	No	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-)	Yes (O)(+)	Yes (O)(+)	Yes (O)(+)	Yes (O)(-)
Phase 5: Dow's Lake Station Entrance (TBD)	Yes (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	No	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-)	Yes (O)(+)	Yes (O)(+)	Yes (O)(+)	Yes (O)(-)
Phase 6: Research Tower (2024-2029)	Yes (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	No	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-)	Yes (O)(+)	Yes (O)(+)	Yes (O)(+)	Yes (O)(-)
Phase 7: Carling Village Towers (2029-2039)	Yes (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	Ye (C)(-) (O)(+)	No	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-)	Yes (O)(+)	Yes (O)(+)	Yes (O)(+)	Yes (O)(-)
Phase 8: Rehab Tower (2024-2028)	Yes (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	No	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-)	Yes (O)(+)	No	Yes (O)(+)	Yes (O)(-)

Project	Decarbonization	Vegetation	Wildlife and Associated Habitat				Species at Risk		Sensitive Receivers	Land Use and Recreation		Plans & Policies	Shadows
	Greenhouse Gas Emissions	Trees	General Habitat	Migratory Birds	Bats	Raptors (Coopers Hawk)	Monarch	Yellow banded Bumble Bee	Noise & Other Sensory Disturbances	Recreation, Greenspace & Aesthetics	Pedestrian & Cycling Facilities	Master Site Plan	Shadows
Phase 9: Main Hospital Building Expansion (2035-2038)	Yes (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	No	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-)	Yes (O)(+)	No	Yes (O)(+)	Yes (O)(-)
Phase 10: Heart institute (2045-2048)	Yes (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	No	Yes (C)(-) (O)(+)	Yes (C)(-) (O)(+)	Yes (C)(-)	Yes (O)(+)	Yes (O)(+)	Yes (O)(+)	Yes (O)(-)

3.0 Cumulative Effect Review

The Cumulative Effects Review highlights projects identified in the scoping process, and the effects of potential VC interactions with the Phase 2 Parking Garage Project residual effects. Mitigation measures have been identified to minimize or eliminate the effects. The significance of the residual effects has been analyzed and recommended monitoring identified where applicable in Error! Reference source not found.. Definitions to the degree of significance are provided below.

Significant (S): An effect that may exhibit one or more of the following characteristics: widespread; permanent transcendence or contravention of legislation, standards or environmental guidelines or objectives; permanent reduction of species diversity of population of species; permanent loss of critical/productive habitat; permanent alteration to community characteristics or services, land use or established patterns; and/or permanent loss of archaeological/heritage resources.

Insignificant (I): An effect that may exhibit one or more of the following characteristics: not widespread; temporary (i.e. only during construction); recurring effect lasting for short periods of time during or after project implementation; not permanent, so that once the stimulus is removed, the integrity of the social/environmental components is resumed.

Negligible (N): A nearly zero or hardly discernible effect. A negligible effect would touch a population, an entity or a specific group of individuals at a localized area and/or over a short period in such a way as to be similar in effect to small random changes in the population, entity or group due to environmental irregularities, but would have no measurable effect on the population, entity or group as a whole.

Positive (P): An effect that exhibits a beneficial outcome.

Not applicable: *(N/A)*

Table 5: Evaluation of Significance

Valued Component		Residual Cumulative Effect	Mitigation	Phase	Significance	Monitoring
Decarbonization	Greenhouse Gases	Decarbonization and TDM strategies and provision of enhanced active transportation facilities will result in a positive contribution to limit greenhouse gas emissions.	• Implement Transportation Demand Management strategies coinciding with operation of the main Hospital Building. • Include low-carbon alternatives in construction specifications. • Implement active transportation facilities. • Implement Landscape Plan.	O	P	• Monitoring per Transportation Demand Management Plan. • Monitor per Plans and specifications prepared for the project.
Vegetation	Trees	Decarbonization and TDM strategies and provision of enhanced active transportation facilities will result in a positive contribution to limit greenhouse gas emissions.	• Implement Transportation Demand Management strategies coinciding with operation of the main Hospital Building. • Include low-carbon alternatives in construction specifications. • Implement active transportation facilities • Implement Landscape Plan.	O	P	• Monitoring per Transportation Demand Management Plan. • Monitor per Plans and specifications prepared for the project.
Wildlife and Associated Habitat	General Habitat	• Temporary loss of general habitat during construction. • Overall increase in the site habitat. Increased canopy cover over the site to introduce new opportunities for birds and wildlife.	• Implementation of Vegetation Management /Conservation Strategy. • See above mitigation in Valued Component for *Trees*	C, O	I, P	Monitor new plantings as per Long Term Tree Canopy Adaptive Management Plan.

Valued Component		Residual Cumulative Effect	Mitigation	Phase	Significance	Monitoring
Wildlife and Associated Habitat	Migratory Birds	• Temporary Loss of bird nesting habitat as a result of construction. Intensive replanting and the increase in canopy cover.	• As a general precaution, tree and vegetation removals (including mowing of tall grass) shall be conducted outside of ECCC's bird nesting window for the Ottawa region (April 8 to August 31). • Active nests of birds protected under the MBCA, ESA and/or the SARA discovered outside the core nesting windows for treed and open habitats must also be protected. • If a nest is identified and is currently inactive, compliance with the Act is still required. Resurvey for nesting activity may be required if the previous nest search occurred greater than 7 days before the work is to commence, if activities are still planned during the migratory bird window. • If vegetation removal is required during the nesting window, a bird nest survey must be carried out by an avian expert 2 days (48 hours) before undertaking the tree and vegetation removals within the core nesting window and following a methodology approved by the Canadian Wildlife Service: https://www.ec.gc.ca/paom-tmb/default.asp?lang=En&n=8D910CAC-1[ec.gc.ca]. • Exclusion measures should be applied as warranted to prevent nesting in stockpiled materials or within any buildings being constructed. • Implement Landscape Plan. • See above mitigation in Valued Component for *Trees.*	C, O	I, P	Monitor health of new plantings as per Vegetation Management Strategy.
		Potential bird strikes with glazed (and reflective) surfaces and entrapments associated with other design elements.	• Incorporation of guidelines including the City of Ottawa Bird Safe Guidelines (2020), NCC Bird Safe Guidelines (2021) and/or CSA Standard A460:19 Bird-Friendly Building Design (2019) into the design. • Implement Bird Friendly Design Guidelines where warranted during the design of the new structure.	O	I	• Monitoring of incidence during operation to identify residual risks and incorporate recommendations for further mitigation. • Monitor as per Bird Friendly Guidelines where warranted.

Valued Component		Residual Cumulative Effect	Mitigation	Phase	Significance	Monitoring
Wildlife and Associated Habitat	Bats	• Temporary loss of potential bat roosting habitat as a result of the removal of large diameter trees during construction. • Intensive replanting and the increase in canopy cover.	• Removal of the suitable cavity trees should occur outside the bat active season (April 1 to September 30) to protect bats. If removal must occur during this window, acoustic surveys / bat exit surveys are recommended. • If vegetation removal is required during the roosting window, a leaf roosting bat survey must be carried out by an avian expert 2 days (48 hours) before undertaking the tree and vegetation removals within the core nesting window. • Implement Landscape Plan. See above mitigation in Valued Component for *Migratory Birds.*	C, O	I, P	Monitor health of new plantings as per Vegetation Management Strategy.
	Raptors (Cooper's Hawk)	No residual cumulative effects have been identified.	N/A	N/A	N/A	N/A
Species at Risk	Monarch	• Temporary loss of vegetation suitable for Monarch foraging and breeding as a result of construction. Pollinator focused planting to enhance habitat for this species.	• Limited potential for impacts as the majority of vegetation removal is to occur outside of the Monarch butterfly's active breeding season (June- September). • As part of the site Landscape Plan, pollinator-focused plantings could be used to enhance habitat for this species.	C, O	I, P	Monitor health of new plantings.
	Yellow-Banded Bumble Bee	• Impact to potential, Yellow-banded Bumble Bee nests or over wintering habitat as a result of works occurring in suitable woodland habitats. • Pollinator focused planting to enhance habitat for this species.	• Segments of the woodlot (where there is potential habitat) are being retained within the larger NCD site, therefore there will be limited overall loss of this habitat type. • As part of the site Landscape Plan, pollinator-focused plantings could be used to enhance habitat for this species.	C, O	I, P	Monitor health of new plantings.

Valued Component		Residual Cumulative Effect	Mitigation	Phase	Significance	Monitoring
Sensitive Receivers	Noise and other sensory disturbances	Noise from construction may be a temporary disturbance.	• Temporary impacts are anticipated to be short-term in duration and insignificant in magnitude, restricted to the project's construction phase. • Contractor to adhere to the City By-laws (2017-255). Keeping equipment well maintained, moving parts lubricated and restricting unnecessary idling. Compliance with MECP NPC- 115 and NPC-118. • Should blasting be used, implement Blast Management Plan/Strategy. The proponent shall provide PSPC and the NCC with a copy of the Blast Management Plan/Strategy (at least 10 business days) prior to construction commencement. • Implement Vibration Monitoring Plan. The proponent shall provide PSPC and the NCC with a copy of the Vibration Monitoring Plan (at least 10 business days) prior to construction commencement.	C	I	Monitor complaints during construction.
Land Use and Recreation	Disruption to Roadway Users.	Temporary disruptions and inconvenience to roadway users as a result of construction activities.	• The Traffic Impact Assessment Completed for the Phase 2 Project indicate that the proposed access plan during construction of the Parking Garage (signalized access at Prince of Wales/Sir John Carling for construction workers and three construction accesses) is expected to adequately accommodate anticipated construction traffic on the adjacent road network. The specific access requirements will be confirmed during the detailed design and development of a Construction Management and Logistics plan by the Contractor. • Implementation of TDM measures during the construction phases will be limited given the primary workforce are trades people/ construction workers that historically have high auto- usage. TOH and the Contractor may consider rideshare/carpooling incentives to reduce auto-usage where possible. • Preparation of additional Traffic Impact Assessments for subsequent phases of NCD where warranted.	C	I	• Monitor Complaints during construction. • Monitor per Construction Management and Logistics plan where applicable.
Land Use and Recreation	Recreation, Greenspace and Aesthetics	Opportunities for recreation, landscaping and enhanced views.	• New opportunities for recreation for all ages and abilities, landscaping and enhanced views of Dow's Lake and the Rideau Canal and Arboretum to be created with new rooftop park.	O	P	Monitor use for new or modified programming opportunities.

Valued Component		Residual Cumulative Effect	Mitigation	Phase	Significance	Monitoring
	Pedestrian and Cycling Facilities	Enhanced pedestrian and cycling crossings at new and modified intersections	• Implementation of Construction Traffic Management Plan to direct pedestrian and cyclists during construction.	O	P	None required.
Plans and Policies	Master Site Plan	Consistent with Plans and Policies.	• Implementation of the NCD development and associated components/phases in accordance with the approved Master Site Plan.	O	P	None required.
Shadows	Shadows	Shadows to occur infrequently over a short period of time each year.	• None proposed. Negligible and indirect impact that is site-specific and will occur infrequently over a short period of time each year.	O	N	None required.

4.0 Conclusion of Cumulative Effects Review

Several projects occurring within the NCD site will either interact spatially or temporally with the valued components identified from the s.82 (IAA) Environmental Effects Analysis (EEA) completed for the Parking Garage project. These projects have been identified as either phases of the NCD project or separate projects occurring within the NCD site or immediately adjacent to it. Following the detailed impact analysis contained within the Phase 2 Parking Garage EEA, it has been determined that residual impacts will impact few valued components. These residual impacts, either positive or negative have been carried forward to complete this Cumulative Effects review.

The majority of potential interactions are positive, mostly occurring during the operational phase of the project, which can be attributed to a state-of-the-art facility and site design through consistency with plans and policies, decarbonization strategies and the reduction of greenhouse gases, landscaping and the implementation of significant compensatory plantings to enhance habitat for wildlife and for the enjoyment of the public, and provisions for recreation, greenspace and pedestrian and cycling linkages.

Identified negative impacts are generally a result of construction activities, and while most can be mitigated, offset or eliminated (i.e. no residual impact), some potential for interaction is unavoidable, even after the implementation of mitigation measures. During construction of the NCD, noise, dust, vibration and other sensory disturbances may be perceived by the public, which may be a nuisance. While this effect is temporary, and only expected to last the duration of the various phases of the NCD construction, the effect can be lessened with the implementation of contemporary and industry accepted best management practices.

The effects from shadows have been identified as a potential operational residual impact, however, shadows would only occur for a short period of time each year, and as such the effect is negligible.

Detailed Impact Assessments through EEA's are required for each subsequent phase of the NCD project as per the Federal Lands Use Approval conditions granted during the Master Site Plan process. Further analysis and detailed studies will be undertaken, and mitigations developed which can be carried forward for any future Cumulative Effects reviews required for the NCD site.

While there are spatial and temporal interactions from past, present and future projects occurring on the NCD site, master site planning will result in negative impacts that are anticipated to have an insignificant cumulative effect and that an overall cumulative positive net-benefit is anticipated.

APPENDIX D: CONSULTATION SUMMARY REPORT

Consultation Summary Report

Revised June 2022

The update includes responses to comments and details of on-going consultation activities since last issue of the consultation summary (revised February 2022). The following table summarizes the additional comments received through the Impact Assessment Agency of Canada (IAAC) Registry or emails received from Agencies that were shared with the project team and where information can be found in the supporting studies where applicable.

KEY ISSUE/IMPACT IDENTIFIED	# OF MENTIONS	SOURCE OF COMMENT	GENERAL RESPONSE PROVIDED BY PROJECT TEAM AND LOCATION OF SUPPORTING INFORMATION.
Site Selection and EA Process			
Concern was raised with respect to the site being chosen over others in the city, particularly Tunney's Pasture.	1	IAAC Registry	The Federal Government has made the decision to lease the former Sir John Carling site to The Ottawa Hospital through a 99-year lease, which came into effect on February 23, 2018. Background to the timing for the Hospital Ground Lease is found in Section 1 of the Environmental Effects Analysis (EEA).
Environment			
Question was posed with respect to protection measures afforded the Kentucky Coffee Tree on the Site.	1	Email to City of Ottawa/NCC	The Kentucky Coffee Tree is designated as a Threatened species under the Act, as assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), only populations within suitable habitat in the species natural range (extreme Southwestern Ontario) are assessed and considered for designation under SARA. The natural range of the Kentucky Coffee Tree is located in extreme Southwestern Ontario where environmental conditions support their habitat. Plantings such as street trees or those planted in human-made landscapes, such as the Ottawa Hospital Site, are excluded from COSEWIC's assessment. As such, the Kentucky Coffee Trees at the Ottawa Hospital site have no protection status under SARA. It should be noted that a significant Replanting Plan is proposed for the Ottawa Hospital Site that includes the Kentucky Coffee Tree as well as other native tree species which are featured heavily in the Plan.
Accessibility			
Concerns were raised with respect to the distance to the Hospital Building from arrival points and provision for direct and safe access to the Hospital Building for pedestrians.	1	IAAC Registry	Universal Accessibility of the new Civic development is a key principle for TOH as outlined in Section 2.1 of the Design Brief and Planning Rationale for the project and the specific approach to accessibility is outlined in Section 2.3.9 of the same report. The objective for the new campus is to not only meet the Health Care Accessibility Standard for the Province of Ontario, but to exceed current accessibility requirements in codes and standards such as the Ontario Building Code (OBC), CSA B651 Accessibility of the Built Environment Standard, the City of Ottawa Accessible Design Standard (COADS) and the Accessibility for Ontarians with Disabilities Act (AODA) Integrated Accessibility Standards Regulations. The new Civic development project will also take into consideration the new AODA Health Care Standard - 2021 initial recommendations report, which identifies the Standards

KEY ISSUE/IMPACT IDENTIFIED	# OF MENTIONS	SOURCE OF COMMENT	GENERAL RESPONSE PROVIDED BY PROJECT TEAM AND LOCATION OF SUPPORTING INFORMATION.
			Committee's initial recommendations for proposed Accessibility Standards for Hospitals in Ontario. Designing for Universal Accessibility will improve the experience for people who live with a range of disabilities and functional or activity limitations, including patients, visitors, staff, and volunteers. The project includes both direct and experiential pathways, all will be accessible, however the more direct pathways are meant to enable accessibility to the main Hospital Building. Additional consideration for the inclusion of people movers or shuttles are being further evaluated and confirmed as part of the main Hospital Building when the pedestrian link is completed as part of that phase.
General			
It was asked if a Federal Environmental Assessment has been undertaken.	1	Community Sessions and IAAC Registry	The Environmental Impact Statement that accompanied the Master Site Plan, noted the requirement for additional detailed impact assessments and mitigation strategies during each phase of development related to physical works of federal lands as well as meeting the requirements of the City's Environmental Impact Statement requirements (EIS). For the Phase 2 Project, an Environmental Effects Analysis (EEA) pursuant to Section 82 of the Impact Assessment Act of Canada has been completed and approved in March 2022 by the federal custodian/landowner (Public Services and Procurement Canada) and the National Capital Commission (responsible for granting federal land use approvals in the National Capital Region) given authority to make the determination prior to issuing approvals or other permits. This report also meets the requirements of the City of Ottawa EIS requirements. Further the Minister of the Environment and Climate Change confirmed the validity of the current process in his determination in response to a community request for the project to become a designated project under the Impact Assessment Act which can be found on Impact Assessment Agency's website by following this link: *https://iaac-aeic.gc.ca/050/evaluations/proj/83234?culture=en-CA [iaac-aeic.gc.ca]*.
Enquiry as to the location of EA documents to-date	1	Email to the Minister of the Environment	Supporting documents to-date including the Environmental Assessment are posted on the City of Ottawa's Development Applications website: https://devapps.ottawa.ca/en/applications/D07-12-21-0159/details
Indigenous Peoples			
Concerns were raised with respect to how Indigenous groups have been consulted as part of the process.	1	IAAC Registry	An Indigenous Peoples Advisory Circle was established with on-going consultations. Details provided below. The Indigenous Peoples Advisory Circle includes regional representation from Indigenous Groups. Individual Stakeholder Meetings at the request of individual groups are also undertaken.

Overview of Consultation with Indigenous Peoples

The Indigenous Peoples Advisory Circle continues to advise The Ottawa Hospital (TOH) about its new Civic development and work to ensure that cultural awareness, inclusion, and safety are integrated in the planning and design of the new hospital and throughout TOH's operations.

The Circle has been meeting for a year. The group has had discussions around creating an inclusive and culturally safe environment in health care, sustainability, and landscape planning at the new campus, and provided feedback on design elements within the new hospital and surrounding site.

Marion Crowe, a member of the Piapot First Nation who is TOH's first Indigenous Board member, chairs the Circle's meetings. A wide variety of organizations representing or serving the health needs of Indigenous peoples have been invited to the Circle, and the hospital is working to actively increase the number of communities and organizations that are represented. Individuals from both Kitigan Zibi and Pikwakanagan First Nation have been present at meetings to date.

Additional meetings have been held or scheduled with members of the Ottawa Aboriginal Coalition to discuss concerns and provide updates about the project.

The project team is exploring possible design components proposed by Indigenous leaders and by the Indigenous Peoples Advisory Circle, including planting traditional medicines and displaying Indigenous-created artwork.

TOH is committed to continuing to strengthen its relationships and engagement with the Indigenous communities it serves to ensure that Indigenous patients and families feel welcome and safe at all TOH campuses. TOH will seek best practices from Canadian organizations in health care and other sectors that have Indigenized spaces, so that these ideas can be integrated into the design of the new campus.

Overview of Meeting with the Preston Street Business Improvement Association

A meeting was held with Preston Street Business Improvement Association representatives on April 5, 2022. Graham Bird of GBA Group and Joanne Read of The Ottawa Hospital provided an update to members on the new Civic development project highlighting site preparation readiness (i.e., tree removal) and timelines for construction of the parking garage, LRT trench widening, piles removal from former Sir John Carling Building and the main Hospital building. Meetings with the Preston Street BIA will continue on a quarterly basis throughout the project.

Overview of Consultation with PSPC and AAFC

Since the signing of the lease with PSPC in 2018 The Ottawa Hospital (TOH) has maintained continuous communication with both PSPC and AAFC. Communications have involved matters pertaining to operations and maintaining the existing property, as well as updates on the status of the new Civic development (NDC) project and discussing research opportunities as part of the overall development plan for the new TOH site. The discussions have taken place with Joel Wilkin Director, Real Estate and Corey Reaney Integrated Services Manager/Central Experimental Farm Agriculture and Agri-Food Canada /Government of Canada on operations and maintenance to continue to develop the relationship as great neighbours. New attendees included: Eric Maltais Assistant Director, Accommodation Services, Claude-Eric Lafrance, Deputy Director Physical Security and Jeremy Dizazzo, Lead Hand, Woody Plants, Ornamental Gardens.

The following areas have been the focus of the conversations.

1. Site Operations and Maintenance: sustaining the support of the DARA Tennis Club, snow removal on the roadways and sidewalks within the leased roads, access for AAFC to hedge collection for sampling and transfer, open space maintenance, security, parking operations between the two properties (AAFC/TOH),

and any matters related to fulfilling our commitment under the good neighbour obligations as outlined in the ground lease.

2. Updates on the status of the project including the Stage 1/2 design proposals to the province and the currently proposed facility plan. TOH provided a walk-through of the design and intended plans with parking and the overall site plan design.
3. Understanding that a transition of responsibility for utilities and services is underway from AAFC to PSPC, TOH will continue working with AAFC to determine next step requirements for utilities relocations and requirements for the buildings that remain on AAFC/CEF lands.
4. Conversations for the access/use of Maple Drive for restricted access for the hospital has been initiated with AAFC.
5. A series of meetings have been held and are planned between TOH/AAFC to discuss how to leverage potential opportunities for collaboration. Several areas of common research interests identified:
    a. Clinical studies of plant-based therapeutics
    b. Microbiome research
    c. Cannabis therapeutics
6. Interest is establishing a Synthetic Biology Foundry of the site which would support applications for agriculture and health research.
7. TOH has tabled opportunities to contribute to further tree coverage beyond the borders of the leased lands as well as offering opportunities to discuss the hedge collection on the lands if desired by AAFC.
8. TOH and PSPC have worked collaboratively over the last year on the coordination of the West Annex Building demolition and the removal of the foundations of the former Sir John Carling Building.

As this is a multi-year complex project these conversations will continue to evolve as the project progresses.